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Contents

SURVEY OF INDOOR AIR QUALITY, VENTILATION, AND SMOKING ACTIVITY IN RESTAURANTS (PART II)

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Abstract

As a CORESTA ETS Sub-Group activity, six different participants in six different countries conducted a survey of indoor air quality, ventilation and smoking activity in restaurants. This work was to assess methods and determine major hurdles to performing such studies in a sound and reliable way. A number of typical medium-priced restaurants were surveyed during lunch and dinner. The objectives were:

1. To survey restaurants in several different countries.
2. To determine acceptability of indoor air conditions as judged by occupants of the restaurant space.
3. To assess concentrations of environmental tobacco smoke (ETS) present in the selected spaces.
4. To appraise the ventilation system including operation and maintenance (O&M) of heating, ventilating, and air conditioning (HVAC) systems and estimate outdoor air ventilation rates.
5. To determine smoking rates in the restaurants observed.
6. To investigate correlation between the smoking rates, ventilation rates, ETS concentrations, and occupant perceptions of restaurant indoor air quality.

A previous paper discussed the protocol and methods of this survey (Bohanon, 1997). This paper discusses the results and conclusions from this survey preceding a final report to CORESTA.

1. Introduction - The Survey

This project was designed to survey restaurants in a number of countries where smoking is permitted. The hypothesis is that most restaurateurs operate their restaurants so that 80% or more of the patrons perceive the air quality to be acceptable.

Restaurants were selected to be typical of the country. The surveys were conducted during typical occupancies at lunch and dinner. The protocol suggested selecting high occupancy days. Thirty-four restaurants in six countries were surveyed, adding valuable data to the published information regarding indoor environmental conditions or ventilation in existing restaurants. This pilot study was not designed to yield representative data for the individual countries due to the small number of samples and the non-random selection of venues.

Tests were conducted by participating companies in their respective countries. The principal investigators by country are: France -Mr. Yves Saint-Jalm; Japan - Dr. Masao Matsukura, Mr. Isao Ishii, Mr. Takuya Asai, Mr. Takumi Nishina; Korea - Dr. Moon Soo Rhee; Switzerland - Dr. J.-J. Piadé, Dr. Matthias Schorp, Dr. Laurant Poget; United Kingdom -Mr. Barrie Frost, Mr. Nigel Warren; United States - Mr. Hoy Bohanon, Mr. David Taylor, Mr. Robin Wilson.

2. Occupant Judgement

Restaurant owners are motivated by business reasons to satisfy their customers. However, unlike comments on obvious items such as food, services and ambience, it is sometimes difficult for the owners to receive feedback specific to indoor air quality. The situation is further complicated by the fact that the owner strives to accommodate a wide range of individual preferences.

Little guidance on how to provide acceptable indoor environmental conditions for restaurants is available. Some national or international ventilation standards or guidelines provide some general information, but that information is generally not specific for the hospitality sector. Following are results of a questionnaire survey focused exclusively on restaurants. These results can be compared to studies from laboratory environments.

The Pilot Study Protocol provided a questionnaire, which has been used in both the U.S. and Japan, and which has been adapted to Europe by France, U.K., and Switzerland. The questionnaires sought basic information on the occupants, and assessed occupants' perception towards a number of indoor environmental conditions, such as noise, temperature, draft, odor, humidity, freshness, tobacco smoke, and indoor environmental quality. In addition, France and Switzerland both added a question concerning indoor air quality, as has recently been done in the European Building Audit (Bluyssen 1995).

Questionnaires were completed on the same days that indoor air measurements were performed. The owners limited the number of questionnaires distributed in each restaurant. The time required to fill out a questionnaire was normally less then five minutes. In general, the wait staff administered questionnaires, typically after they took orders for lunch or dinner. Some patrons declined to answer the questionnaires. The wait staff did not record the number declined. The completed questionnaires were returned to the wait staff. For their service, the wait staff received a small gratuity for the additional workload.

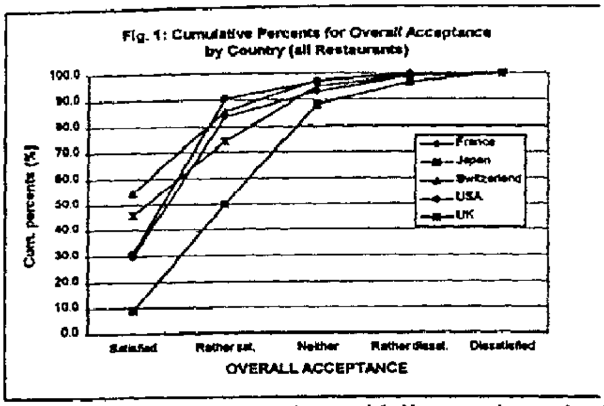
For the analysis of the questionnaires, the responses on the 5-point scales were converted to "Satisfied" or "Dissatisfied." The responses marking the two lower ratings ("Rather Dissatisfied" and "Dissatisfied") were combined to estimate the "% Dissatisfied" with each of the indoor environmental parameters. The 10-point scale was analyzed as in the European Building Audit (Bluyssen 1995). The "% Dissatisfied" with indoor air quality (IAQ) and indoor environmental quality (IEQ) were averaged to derive the inverse estimate of "% Overall Acceptance." A subset of the data was analyzed, after the exclusion of restaurants that had less than 20 questionnaires returned or had highly variable ventilation rates.

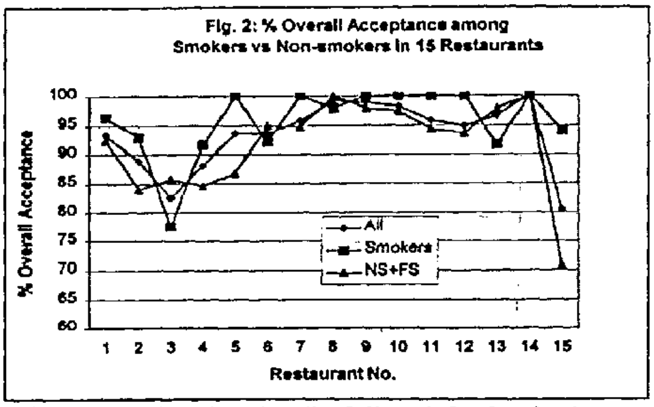
1370 questionnaires were returned by the restaurant patrons in five countries. Table 1 presents the combined country "% Dissatisfied" per indoor environmental parameter. Dissatisfaction rates above 20% are seen for Draft, Freshness and Noise. Dissatisfaction rates with regard to indoor air quality and indoor environmental quality are generally below 10% and are not significantly different. Both ratings were subsequently combined to yield the inverse estimate of overall acceptance.

Table 1: Questionnaires – Summary Restaurants "Percent Dissatisfied"

Country	Temp	Humid	Draft	Fresh	Smoke	Noise	Odor	IAQ	IEQ
France	5.7	8.7	5.0	37.9	17.5	27.0	10.5	7.8	6.9
Japan	4.3	17.4	6.5	19.6	12.0	31.5	2.2	n.d.	12.0
Switzerland	3.9	38.5	12.0	15.8	14.2	15.8	19.1	3.1	2.7
USA	8.0	15.8	9.2	7.7	12.9	17.2	8.1	n.d.	3.0
UK	7.2	11.8	n.d.	n.d.	2.7	n.d.	n.d.	5.0	n.d.

Figure 1 depicts the cumulative percentages for overall acceptance per country for all restaurants. Figure 2 shows the ratings for overall acceptance separating the data into smoker and nonsmoker responses for those restaurants having more than 20 questionnaires returned, and which did not have highly variable ventilation rates. In general, non-smokers tend to be slightly more dissatisfied than are smokers.





Indoor environmental design guidelines and standards provide for "limit values" of dissatisfaction in the range of 10 - 30% (EUR 14449 EN, 1992) or for more than 80% acceptance (ASHRAE 62-1989). The guidance is based on experimental studies (Cain 1983) or field tests in some workplace environments (Fanger 1988). The data presented above indicate that physical stressors such as noise and draft challenge those limits. On the other hand, occupants in real-world environments appear to have different expectations towards air quality parameters. The acceptance rate is indeed substantially higher than what would have been predicted from those studies above, including the most recent by Walker et al. 1997.

3. Concentration of ETS

The CORESTA Restaurant Pilot Study combined the efforts from six different laboratories in as many different countries. A large amount of data was generated, reflecting the diverse situations that can be encountered when monitoring indoor air constituents in restaurants. Despite an initial agreement on the nature of the analytes and the methods to assess their levels, the difficulties of conducting this Pilot Study highlight the need for a commonly agreed methodology and validation of that methodology, including field tests.

Detection of outliers

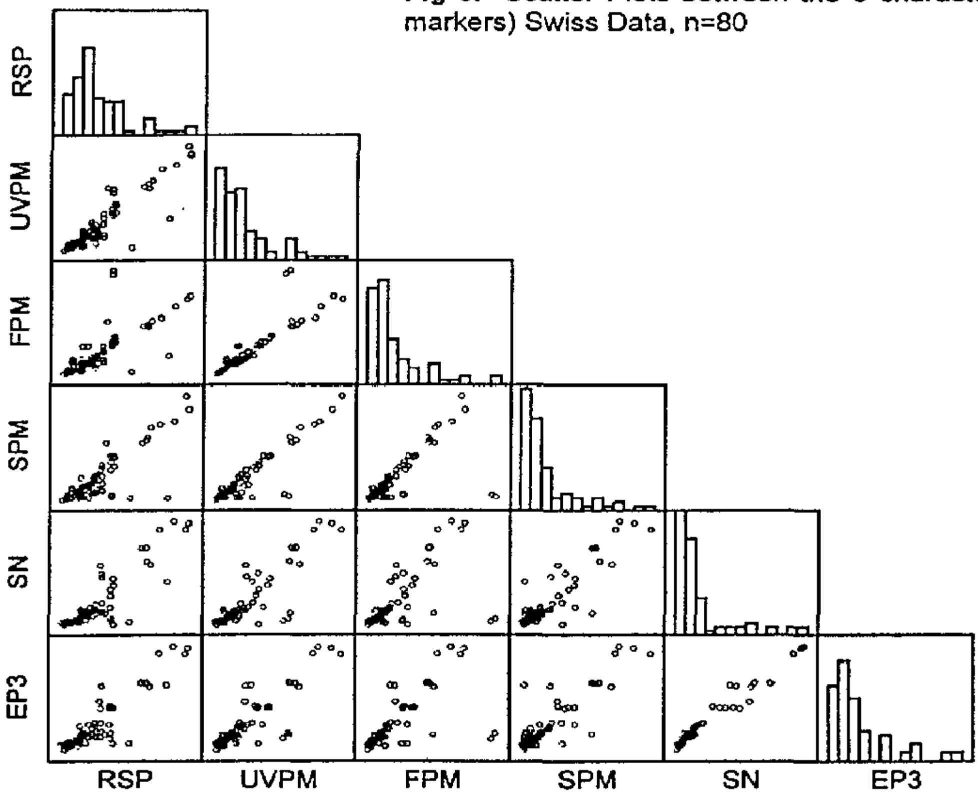
Indoor air monitoring in restaurants often calls for environmental analyses at the ppb level. Despite the great care taken in performing the measurements, and even if the method is well controlled, (as checked by QA samples) erroneous results often do occur. They may be due to failures in the sampling, or may be the result of a strongly inhomogeneous environment. In addition, ETS markers, such as UVPM and FPM, may yield implausibly high results due to interference from other combustion sources.

It is very useful to obtain two or more replicate determinations per location. This helps to detect outliers and may give an indication of the most plausible result. In this data set, about 5% of the raw data were outliers. Additional information can be derived, however, from the auto-correlation that prevails among the set of ETS markers as discussed below. It is not a simple task to perform this two-dimensional cross-checking using statistical tools, therefore the outliers were identified by visual evaluation. Completion of the CORESTA inter-laboratory study that is on-going for all these methods should help in detecting outliers by providing an estimate of the method reproducibility.

Results and correlation

As an example, the scatter plots showing all the cross-correlation between the analytical parameters for the Swiss data set are shown in Figure 3. The monitored ETS-markers fall into two groups: the gas-phase compounds (nicotine *SN* and 3-ethenylpyridine *EP3*) and the particulate-phase compounds (the UVPM and FPM estimations and solanesol). In addition, the respirable suspended particles (RSP) are also reported. The estimations of the level of ETS-derived particulate matter (or ETS-RSP) were performed as recommended in Nelson et al., 1997. It could be done also on the basis of the solanesol concentration yielding the SPM value.

Fig 3. Scatter Plots between the 6 characteristics (RSP, markers) Swiss Data, n=80



These plots, as well as those generated from the other countries' data sets, suggest the following observations:

- Within the particulate-phase, there is a very good correlation between the two spectrometric estimations. This is not surprising since both determinations are made from the same sample. Conversely, an outlying point should be investigated for possible interference. There are two obvious cases (discussed below) in the Swiss data set.
- The solanesol concentration (or the derived S-PM estimation) is also well correlated with UVPM or FPM. There are, however, some points that show lower S-PM than UVPM or FPM, mostly at low

smoke levels. This effect is illustrated in Figure 4, showing the ratio of S-PM to UVPM as a function of UVPM.

- Over the whole data base, it appears that the RSP level does not correlate well with ETS-PM (or ETS-RSP) levels.
- The gas phase data are well correlated. There is a trend towards a lower nicotine / 3-ethenylpyridine ratio at lower smoke levels as illustrated in Figure 5 that shows this ratio as a function of nicotine levels. As nicotine exhibits much larger sorption effects, this ratio will be higher in fresh ETS which is more likely to contribute to those situations where ETS levels are higher (Eatough 1993, Guerin 1992).

Fig 4. Solanesol-PM/UVPM vs UVPM (Swiss Data)

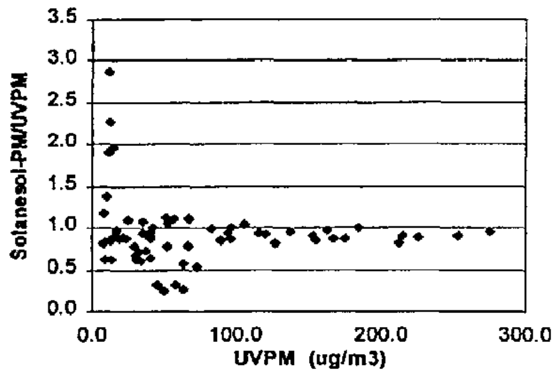
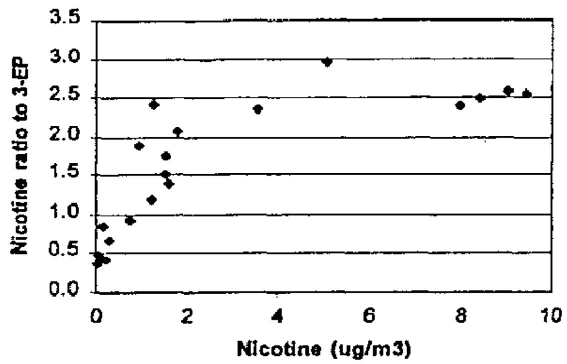


Fig. 5 Nicotine/3-EP ratio vs. nicotine level (US data)



Methodology assessment: technical remarks

The examination of the different data sets suggests the following observations:

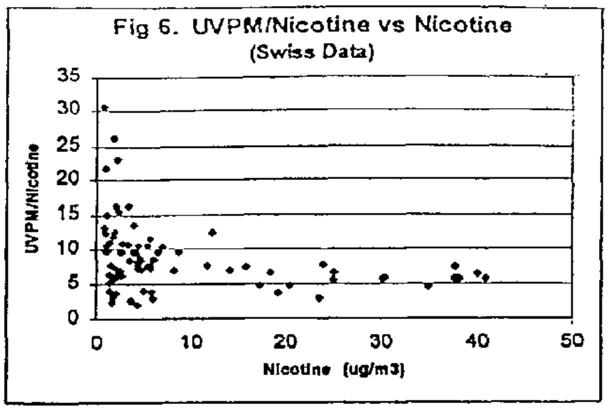
- The problems that were noticed in some countries with the solanesol analysis could be traced to a sampling in transparent filter holders and to a modification in the HPLC procedure.
- A non-zero intercept in the regression line of UVPM vs. FPM occurred in one data set, suggesting an erroneous blank correction.
- The variability among replicates increased at higher ETS levels. It is possible that some of these high measurements resulted from direct exposure of one sampling port to a smoke source, yielding an analytical value that is not representative of the assessed environment.
- Finally, some data sets exhibited an elevated scatter that could not be explained. Completion of the on-going inter-laboratory study for all these methods should reduce sources of variability and provide an estimate of method reproducibility.

Methodology assessment: Interpreting results from the different analytes

The results for the PM evaluation can also be correlated to the gas phase data. The scatter is higher, reflecting the physical differences between both classes of compounds, and the fact that ratios between the levels of gas phase and particulate phase compounds become extremely variable at low ETS concentrations. See figure 6 (Swiss data) showing that the ratio of SolPM to nicotine exhibits a large scatter below 5-10 $\mu g/m^3$. However, in many of the cases when very low values were found for

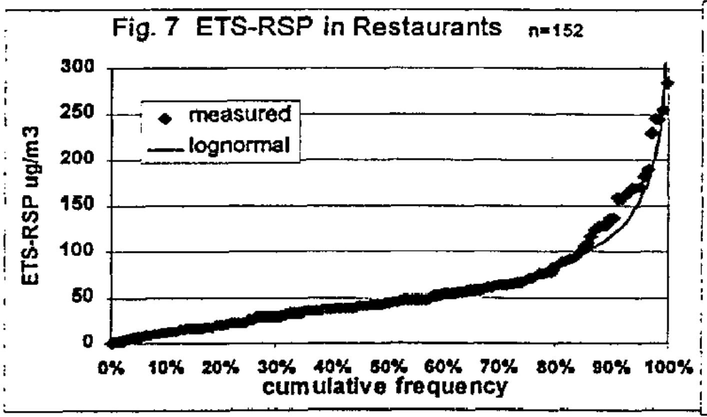
solanesol, compared to the spectrometric markers (UVPM or FPM), the nicotine levels were also very low suggesting that an artifact elevated the spectrometric results.

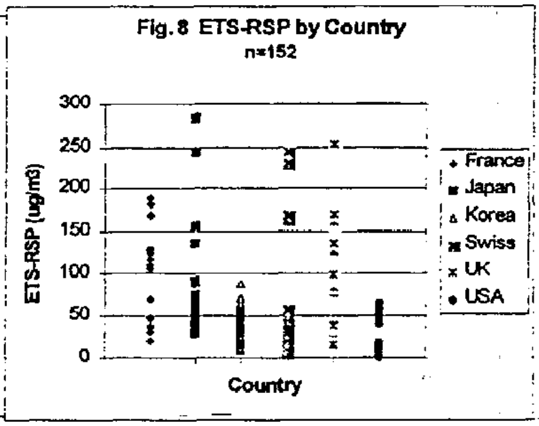
In the Swiss data set, the two samplings that yielded highly elevated results for UVPM and FPM could be traced. It appeared that the errors were due to the presence of an open fireplace in the room. In this case, the solanesol still provided an estimation of ETS-RSP.



ETS Concentrations

Figure 7 shows the distribution of the best estimates for ETS-RSP concentrations while figure 8 shows a plot of concentrations by country.





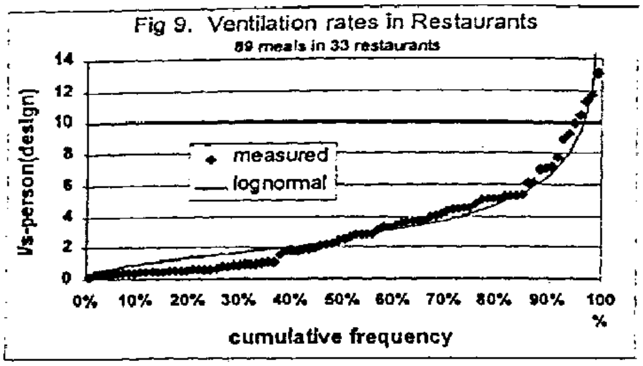
4. Ventilation

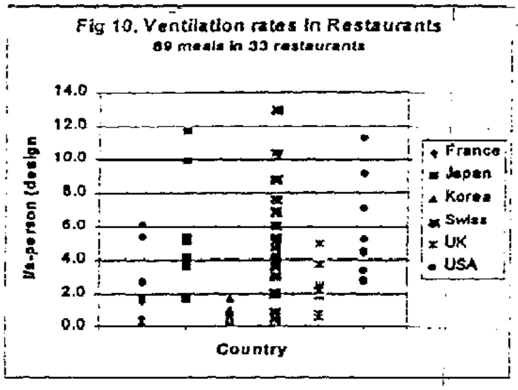
There are different ways to estimate ventilation rates

They include:

1. Measuring the rate of the air introduced into the restaurant through mechanical means. These direct measures are accurate if all of the air is controlled through a mechanical system. If there is significant infiltration, these methods will underestimate the ventilation rates.
2. Using CO_2 as a tracer gas where the volume generated is estimated as a function of the number of people present.
3. Using an introduced tracer gas such as SF_6.

A simple dynamic model using CO_2 as a tracer gas provides estimates for the total mechanical plus infiltration air in the restaurants. Where there are multiple days or measurements, the average is used as the best estimate. Restaurants are categorized as having highly variable ventilation if (1) the estimated ventilation varies by a ratio of 2:1 or greater; or if (2) the constant ventilation model does not visibly fit the observed conditions.



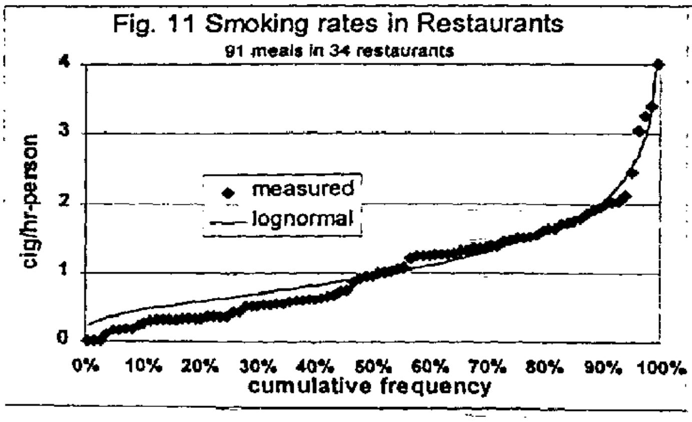


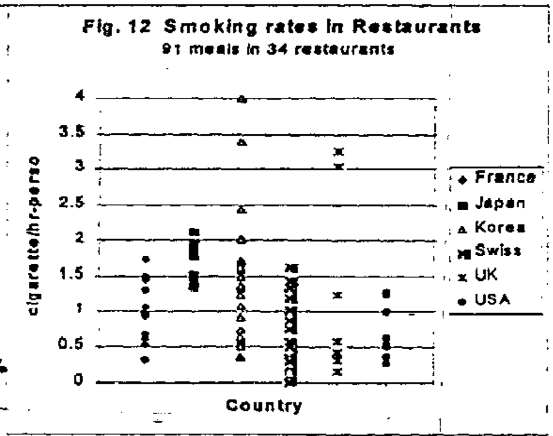
In the survey, 89 meals were observed in 33 restaurants from which a ventilation rate can be estimated. It is usual to normalize the ventilation rates in some way to take into account the scale of the location. One method is to compare to the area and another is to compare to the population. In design standards, the area and person normalization sometimes become a simple ratio due to the fact that maximum occupancy is stated as a constant ratio to area. In the following, the ASHRAE 62-1989 factor of 70 people per 100 m^2 is used as the design value. The design rates for maximum occupancy are shown as l/s-person (design).

The graphs of the distribution of measured ventilation rates in Figure 9 are shown in terms of l/s-person (design). Figure 10 shows ventilation rate by country. A ventilation standard rate of 10 l/s-person (ASHRAE 62-1989) is highlighted as a reference value. A lognormal distribution seems to fit this data set. The median is 2.5 l/s-person. The geometric standard deviation is 2.1.

5. Smoking Rates

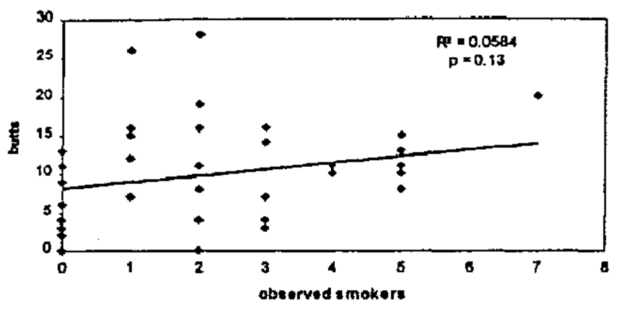
Figures 11 and 12 illustrate the smoking rates measured in the restaurants in terms of cigarettes per hour per person. This observational data also can be fit by a lognormal distribution.





The protocol recommended two methods of determining the smoking rates. The first method is to collect and count the cigarette butts periodically (every thirty minutes). Another method tried in this survey was to count the number of people smoking every thirty minutes. Figure 13 illustrates that these methods do not correlate. Some of the survey participants used a third method - continuous observation of smoking behavior. This method obviously would not have the problems observed with the thirty-minute smoker counts.

Fig. 13 butts vs. observed smokers



6. Correlation between occupant judgement, ETS level and ventilation

Figure 14 indicates no relationship between ventilation rates and overall acceptance. Figure 15 provides little evidence for a relationship between ETS-RSP levels and overall acceptance, as perceived by the patrons in a real-world environment. Acceptance for tobacco smoke (not shown) was almost equally high, with a tendency of the nonsmokers clustering around the 80% acceptance level at any measured ETS levels.

Fig 14. % Overall Acceptance vs Ventilation among Smokers and Nonsmokers in 15 Restaurants

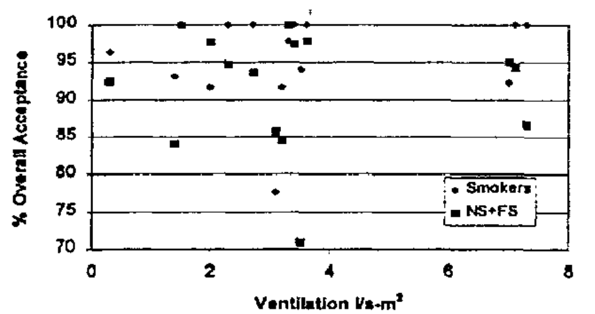
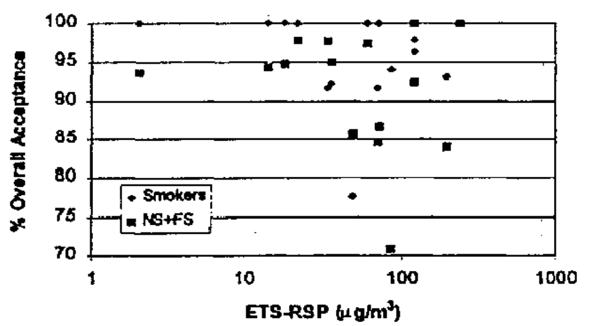


Fig 15. % Overall Acceptance vs ETS-RSP among Smokers and Nonsmokers in 15 Restaurants



Conclusions

The Restaurant study undertaken by the CORESTA ETS Sub-Group was conceived as a pilot study to determine the main methodological problems encountered in measuring indoor air constituents, determining ventilation rates, and assessing indoor air quality acceptability. From this experiment, it is possible to make several recommendations to improve protocols used in such surveys and improve the quality of the collected data.

Questionnaire

The survey returned 1370 questionnaires that were analyzed to estimate the "Percent Dissatisfied" towards a list of indoor environmental parameters. Dissatisfaction rates above 20% are seen for Draft, Freshness and Noise. Dissatisfaction rates with regard to indoor air quality (IAQ) and indoor

environmental quality (IEQ) are generally below 10%, with no significant difference in responses to questions about IAQ and IEQ where both questions were asked. This dissatisfaction rate is lower than predicted from laboratory tests or non-industrial workplace indoor environments such as offices. A new questionnaire will be proposed, which, based on the results of this pilot study, will focus on fewer parameters. In addition, a restructuring of the questions would help avoid response transformations.

Chemical measurements

Methodological differences in the various methods used by different laboratories may impair the comparability of the resulting data. Ideally, the protocol should rely on fully standardized methods (i.e. ISO Standards) and require the participating laboratories apply the prescribed methodology. Another advantage of using standardized methods is that the variability parameters of such methods are known, making data interpretation easier. Standardized methods are available or in preparation for RSP, UVPM, FPM, solanesol, nicotine and 3-ethenylpyridine as ETS markers in indoor air.

Consolidating information from different markers greatly helps reducing the sources of bias in the determinations. Solanesol appears to be a reliable marker for ETS-PM. Its inherent advantage is that one can report an absolute concentration for a tobacco-specific compound, in addition to using it as a surrogate standard that is linked through laboratory experiments to an ETS-PM level (like the spectroscopic determinations).

ETS particulate phase/vapor phase ratios are highly variable at ETS concentrations usually found under conditions of adequate ventilation or moderate smoking rates. At higher ETS concentrations, these ratios are more consistent, but the correlation between gas-phase and particulate-phase markers does not appear to be sufficiently robust to recommend sampling markers for one class only.

The choice of sampling locations in tested areas is critical. It is not possible to recommend a single method for selecting the sampling points due to the variety of situations encountered in the real world. Great care should be taken to select sampling points that give the "best estimates" of the measured parameters and their variability in the tested area (taking into account smoking and non smoking sections, if present). Practical considerations like space availability, disturbance, etc. may also reduce the choice. Taking duplicate samples at each sampling point in order to eliminate possible outliers is recommended. The available methods to evaluate ETS in indoor air require sampling periods of several hours and thus give only an average value over that period. As the concentrations of ETS related compounds may vary considerably during testing periods, methods for measuring ETS compounds on a short period basis would be a helpful tool for a more accurate assessment of the temporal and spatial variability of the ETS concentrations.

Ventilation

The determination of ventilation rates in tested restaurants by direct measure of mechanical systems was quite difficult. A modeling method proved useful in this study. CO_2 levels were measured continuously and a mathematical model was used to calculate the ventilation rates taking into account the occupancy and volume of test spaces. This method requires several features:

- counting precisely all the people present in the tested area (patrons, employees and investigators)
- choosing correctly the CO_2 sampling points (ideally near the exhaust if there is only one)
- measuring indoor and outdoor CO_2 level.

However, this method does not give accurate results in the following situations:

- in case of multiple connected rooms because the calculation model is difficult to establish and because more extensive measurements are required

- in case of low occupation rate, because the CO_2 levels are too close to the threshold and the calculation is practically impossible.

Two alternative methods may be used. These methods were not tested. One established method uses SF_6 as tracer gas. CO_2 decay with the ventilation system on after the establishment has closed and the people have left should be studied as an alternate method. The SF_6 tracer gas method is potentially the best one.

The ventilation system audit should remain included in the protocol.

Observations

This study has demonstrated that the smoking rate should be determined by counting the butts rather than a visual assessment of the number of people smoking. A constant visual monitoring regime is acceptable. It is also important to count all the people present in the tested locations and not only the clients.

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CORESTA ETS SUBGROUP
RESTAURANT STUDY IN SWITZERLAND

Questionnaire – Summary of statistical results and interpretation

Matthias K. Schorp, Ulrich Kreuter (statistician)

Contents:

1. Introduction

CORESTA ETS SUBGROUP has organized and conducted a restaurant survey on indoor air quality (IAQ) in several countries.

The planning and results of collected data of restaurant surveys are described in various documents and reports.

In order to gain information about the occupants' perception in Switzerland, PME has conducted the survey study with a questionnaire on indoor air quality in restaurants by means of sampling clients in 5 restaurants in West Switzerland (Suisse Romande).

Based on the results of the statistical analysis of PME survey, described in the corresponding draft reports, the CORESTA ETS Subgroup has proposed a summary of the statistical results at their meeting in Paris, April 23-24, 1997.

In this document the results of the statistical analysis of the PME survey in Switzerland are represented according to the CORESTA scheme.

2. Short description of the study survey and collected data

The considered population is defined as the population of clients' perceptions for air characteristics in selected restaurants during the sampling period. Each of the 5 restaurants is intended to sample during 2 days.

5 restaurants:
- 1 = Chalet Suisse (Canton Vaud)
- 2 = Hôtel Relais Walker (Canton Valais)
- 3 = Auberge des Collines (Canton Valais)
- 4 = Buffet de la Gare CFF (Canton Jura)
- 5 = La Maison du Prussien(Canton Neuchâtel)

The considered unit (subject) is defined as the client.

Clients' characteristics

Gender	1 = male 2 = female
Age	1 = 'age <30' years 2 = 'age 30-49' 3 = 'age ≥50'
Smoking status	1 = former smoker 2 = non-smoker 3 = smoker

Smoking status	1 = former smoker 2 = non-smoker 3 = smoker
Presence time (at restaurant before questioning)	1 = '<30 min' 2 = '≥30 min'

Characteristics of air quality

Accept (IAQ: Indoor Air Quality) (in PME survey assessed according to this scale)	1 = satisfied, 2 = dissatisfied

Questions under point 8 in the original Restaurant Test Protocol:
Temperature (question 8a)
Draft (8c)
Humid (humidity, 8j)
Fresh (8h)
Smoke (8e)
Noise (8d)
Odor (8b)
Odor quality (8k)
Environment (8l)

All corresponding scale used in the PME questionnaire are transformed to the uniform scale:
1 = satisfied
2 = rather satisfied
3 = neither
4 = rather dissatisfied
5 = dissatisfied

Data

Data were collected during two days at 3 restaurants in November 1996 at 2 restaurants in January 1997.

Restaurant	Questionnaires
Chalet Suisse	79
Hôtel Relais Walker	50
Auberge des Collines	37
Buffet de la Gare CFF	56
La Maison du Prussien	42
Total	264

The effective study sizes and missing values per considered characteristic and group can be seen in the result tables.

3. Results

3.1 Part 1: General data description

1) Description of questionnaire results (total and for each restaurant)

- Number of questionnaires
- Missing values (number and precentage)
- Results (number and percentage)
- Summary for % dissatisfied
- Clients characteristics

Tables 1-4:	Total (all restaurants)
Tables 5-8:	Chalet Suisse
Tables 9-12:	Relais Walker
Tables 13-16:	Auberge des Collines
Tables 17-20:	Buffet de la Gare CFF
Tables 21-24:	La Maison du Prussien

2) Summary for percent dissatisfied

Table 25:	Percent dissatisfied per characteristic, total and restaurant

3) Histograms of air quality characteristics

Figures 1-10:	Frequency distribution per characteristic, total and restaurant

4) Means of numeric values according to the used scale

Table 26-30:	Means per characteristic according to restaurants and client characteristics
Figures 11-15:	Mean profile per restaurant (and total) in dependence of the characteristic

<u>Comments</u>

There are evident differences between restaurants (compare for instance with figure 11).

The mean differences between groups according to restaurant, gender, age, smoking status or presence time are further described in the parts 2 and 3.

The percents of dissatisfied clients for individual air characteristics seem to be rather high (primarily for draft, then lower for odor quality, fresh, noise, smoke, humid and odor). But for the two global air characteristics "Environment" and "Acceptability" the percent dissatisfied is very low (compare with table 25).

3.2 Part 2: Group comparisons by means of contingency tables

Significance results of the group comparison by means of the statistical analysis of contingency tables:

Table 31:	Significance results of group comparison according to restaurant or client characteristic by means of 5 used values (1=satisfied, 2=rather satisfied, 3=neither, 4=rather dissatisfied, 5=dissatisfied)
Table 32:	Significance results of group comparison according to restaurant or client characteristic by means of 2 values (1-3=satisfied, 4-5=dissatisfied)

<u>Comments</u>

Here the groups according to restaurant, gender, age, smoking status or presence time are compared by means of the individual relative frequencies obtained in the contingency tables. In part 3 the groups are compared by means of the parameter "Mean (average value)".

On the whole the group differences described in the parts 2 and 3 are more or less similar. They are commented in part 3.

3.3 Part 3: Group comparisons by means ANOVA

Significance results of the group comparison by means of the statistical analysis of variance (ANOVA) or Kruskal-Wallis test (a test under non-parametric conditions):

Table 33:	Significance results of group comparison according to restaurant or client characteristic by means of ANOVA (with 5 used values 1=satisfied, 2=rather satisfied, 3=neither, 4=rather dissatisfied, 5=dissatisfied)
Table 34:	Significance results of group comparison according to restaurant or client characteristic by means of Kruskal-Wallis test (with 5 used values 1=satisfied, 2=rather satisfied, 3=neither, 4=rather dissatisfied, 5=dissatisfied)

Comments

There are highly significant mean differences between restaurants, in first order for draft, odor quality, odor and fresh, then for environment and smoke (compare with figure 11 and table 34, too).

There are significant mean differences between age classes, in first order for odor quality, environment, odor, then for noise, smoke, fresh and temperature. In general the older clients are more satisfied with indoor air characteristics than the younger clients (compare with figure 14 and table 34).

There are some significant mean differences between smoking status, in first order for odor, odor quality and environment. In general the tendency is recognizable that the former smokers are more satisfied than the nonsmokers and smokers (compare with figure 13 and table 34).

Between the groups according to gender and presence time the mean differences are rarely significant (compare with figures 12 and 15 and table 34).

3.4 Part 4: Correlation coefficients between air quality characteristics

Significance results for correlation coefficients between air characteristics by means of the statistical analysis of contingency tables (an asymptotic t test under transformed conditions):

Table 35-44: Significance results of correlation coefficients per air characteristic according to total or restaurant by means of analysis of contingency tables (with 5 used values 1=satisfied, 2=rather satisfied, 3=neither, 4=rather dissatisfied, 5=dissatisfied)

Comments

In the tables 35-44 are only illustrated the significance results, the direction of the correlation (positive or negative) can not be seen. In most cases the correlation coefficient between the air characteristics are positive. There are numerous significant correlation coefficients, but on the whole the extents and the practical importance of the correlation coefficients are not so large.

To gain a clear and uniform overview on the correlations between the air characteristics is not so easy. Perhaps the following tendencies can be stated:
- The more or less global characteristic "Environment" is in general correlated positively and significantly with other air characteristics as odor, odor quality, fresh, temperature, smoke and noise (compare for instance with table 43).
- Odor quality, odor, fresh, smoke and noise show the general significant tendency to be correlated positively (compare with tables 42 to 38).
- Draft shows the general significant tendency to be correlated negatively with fresh, smoke, noise, humidity, environment and odor (compare with tables 36).
- Temperature is only positively correlated to environment, then to odor and noise (compare with table 35).
- Humidity is only positively correlated to draft and smoke (compare with table 37).

6. References

(1)
Microsoft Corporation (1997). Microsoft EXCEL Version 7.0 - User's Guide. Cambridge MA, USA.

(2)
Dixon,W.J. (1995) BMDP Statistical Software Manual - Volume 1. University of California Press, Berkeley, Los Angeles, Oxford.

All restaurants

Questionnaires	264

Table 1

	Satisfied	Rather satisfied	Neither	Rather dis-satisfied	Dissatisfied	Total	Missing values	% missing values
Temperature	153	78	17	7	3	258	6	2.3
Draft	77	17	58	33	62	247	17	6.4
Humid	106	14	56	7	17	200	64	24.2
Fresh	35	70	66	16	16	203	61	23.1
Smoke	83	55	44	18	12	212	52	19.7
Noise	68	80	70	23	18	259	5	1.9
Odor	82	64	37	16	7	206	58	22.0
Odor quality	97	57	28	23	20	225	39	14.8
Accept (IAQ)	252			8		260	4	1.5
Environment	142	82	30	7	0	261	3	1.1

Table 2

	% satisfied	% rather satisfied	% neither	% rather dissatisfied	% dissatisfied	% total
Temperature	59.3	30.2	6.6	2.7	1.2	100
Draft	31.2	6.9	23.5	13.4	25.1	100
Humid	53.0	7.0	28.0	3.5	8.5	100
Fresh	17.2	34.5	32.5	7.9	7.9	100
Smoke	39.2	25.9	20.8	8.5	5.7	100
Noise	26.3	30.9	27.0	8.9	6.9	100
Odor	39.8	31.1	18.0	7.8	3.4	100
Odor quality	43.1	25.3	12.4	10.2	8.9	100
Accept (IAQ)	96.9			3.1		100
Environment	54.4	31.4	11.5	2.7	0.0	100

Table 3

	% dis-satisfied
Temperature	3.9
Draft	38.5
Humid	12.0
Fresh	15.8
Smoke	14.2
Noise	15.8
Odor	11.2
Odor quality	19.1
Accept (IAQ)	3.1
Environment	2.7

Table 4

	Count	%	Missing	% miss.
Gender			3	1.1
Male	183	70.1		
Female	78	29.9		
Age			2	0.8
<30	50	19.1		
30-49	132	50.4		
>50	80	30.5		
Smoking status			1	0.4
Smoker	99	37.6		
Non smoker	128	48.7		
Former smoker	36	13.7		
Time presence			2	0.8
<30 min	107	40.8		
>30 min	155	59.2		

Chalet Suisse

Questionnaires	79

Table 5

	Satisfied	Rather satisfied	Neither	Rather dis-satisfied	Dissatisfied	Total	Missing values	% missing values
Temperature	38	36	0	2	0	76	3	3.8
Draft	27	10	6	23	9	75	4	5.1
Humid	36	13	19	4	3	75	4	5.1
Fresh	6	22	19	12	14	73	6	7.6
Smoke	28	17	13	7	8	73	6	7.6
Noise	24	13	16	13	11	77	2	2.5
Odor	15	28	19	10	4	76	3	3.8
Odor quality	17	13	10	17	19	76	3	3.8
Accept (IAQ)	74			5		79	0	0.0
Environment	25	34	14	5	0	78	1	1.3

Table 6

	% satisfied	% rather satisfied	% neither	% rather dissatisfied	% dissatisfied	% total
Temperature	50.0	47.4	0.0	2.6	0.0	100
Draft	36.0	13.3	8.0	30.7	12.0	100
Humid	48.0	17.3	25.3	5.3	4.0	100
Fresh	8.2	30.1	26.0	16.4	19.2	100
Smoke	38.4	23.3	17.8	9.6	11.0	100
Noise	31.2	16.9	20.8	16.9	14.3	100
Odor	19.7	36.8	25.0	13.2	5.3	100
Odor quality	22.4	17.1	13.2	22.4	25.0	100
Accept (IAQ)	93.7			6.3		100
Environment	32.1	43.6	17.9	6.4	0.0	100

Table 7

	% dis-satisfied
Temperature	2.6
Draft	42.7
Humid	9.3
Fresh	35.6
Smoke	20.5
Noise	31.2
Odor	18.4
Odor quality	47.4
Accept (IAQ)	6.3
Environment	6.4

Table 8

	Count	%	Missing	% miss.
Gender			1	0.4
Male	37	47.4		
Female	41	52.6		
Age			0	0.0
<30	11	13.9		
30-49	46	58.2		
>50	22	27.8		
Smoking status			0	0.0
Smoker	39	49.4		
Non smoker	34	43.0		
Former smoker	6	7.6		
Time presence			0	0.0
<30 min	13	16.5		
>30 min	66	83.5		

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Relais Walker

Questionnaires	50

Table 9

	Satisfied	Rather satisfied	Neither	Rather dis-satisfied	Dissatisfied	Total	Missing values	% missing values
Temperature	33	9	4	0	3	49	1	2.0
Draft	23	0	12	0	9	44	6	12.0
Humid	14	0	12	3	5	34	16	32.0
Fresh	9	14	14	9	2	48	2	4.0
Smoke	8	12	9	6	0	35	15	30.0
Noise	16	16	11	3	3	49	1	2.0
Odor	20	7	5	3	2	37	13	26.0
Odor quality	13	15	7	1	0	36	14	28.0
Accept (IAQ)	50			0		50	0	0.0
Environment	30	12	8	0	0	50	0	0.0

Table 10

	% satisfied	% rather satisfied	% neither	% rather dissatisfied	% dissatisfied	% total
Temperature	67.3	18.4	8.2	0.0	6.1	100
Draft	52.3	0.0	27.3	0.0	20.5	100
Humid	41.2	0.0	35.3	8.8	14.7	100
Fresh	18.8	29.2	29.2	18.8	4.2	100
Smoke	22.9	34.3	25.7	17.1	0.0	100
Noise	32.7	32.7	22.4	6.1	6.1	100
Odor	54.1	18.9	13.5	8.1	5.4	100
Odor quality	36.1	41.7	19.4	2.8	0.0	100
Accept (IAQ)	100.0			0.0		100
Environment	60.0	24.0	16.0	0.0	0.0	100

Table 11

	% dis-satisfied
Temperature	6.1
Draft	20.5
Humid	23.5
Fresh	22.9
Smoke	17.1
Noise	12.2
Odor	13.5
Odor quality	2.8
Accept (IAQ)	0.0
Environment	0.0

Table 12

	Count	%	Missing	% miss.
Gender			1	2.0
Male	43	87.8		
Female	6	12.2		
Age			0	0.0
<30	10	20.0		
30-49	20	40.0		
>50	20	40.0		
Smoking status			0	0.0
Smoker	11	22.0		
Non smoker	27	54.0		
Former smoker	12	24.0		
Time presence			0	0.0
<30 min	20	40.0		
>30 min	30	60.0		

Auberge des Collines

Questionnaires	37

Table 13

	Satisfied	Rather satisfied	Neither	Rather dis-satisfied	Dissatisfied	Total	Missing values	% missing values
Temperature	25	9	1	1	0	36	1	2.7
Draft	5	1	11	3	15	35	2	5.4
Humid	15	0	4	0	3	22	15	40.5
Fresh	3	7	12	0	0	22	15	40.5
Smoke	9	8	7	1	2	27	10	27.0
Noise	12	8	10	3	4	37	0	0.0
Odor	13	6	3	1	1	24	13	35.1
Odor quality	15	9	4	1	1	30	7	18.9
Accept (IAQ)	32			2		34	3	8.1
Environment	23	10	3	1	0	37	0	0.0

Table 14

	% satisfied	% rather satisfied	% neither	% rather dissatisfied	% dissatisfied	% total
Temperature	69.4	25.0	2.8	2.8	0.0	100
Draft	14.3	2.9	31.4	8.6	42.9	100
Humid	68.2	0.0	18.2	0.0	13.6	100
Fresh	13.6	31.8	54.5	0.0	0.0	100
Smoke	33.3	29.6	25.9	3.7	7.4	100
Noise	32.4	21.6	27.0	8.1	10.8	100
Odor	54.2	25.0	12.5	4.2	4.2	100
Odor quality	50.0	30.0	13.3	3.3	3.3	100
Accept (IAQ)	94.1			5.9		100
Environment	62.2	27.0	8.1	2.7	0.0	100

Table 15

	% dis-satisfied
Temperature	2.8
Draft	51.4
Humid	13.6
Fresh	0.0
Smoke	11.1
Noise	18.9
Odor	8.3
Odor quality	6.7
Accept (IAQ)	5.9
Environment	2.7

Table 16

	Count	%	Missing	% miss.
Gender			0	0.0
Male	34	91.9		
Female	3	8.1		
Age			1	2.7
<30	4	11.1		
30-49	17	47.2		
>50	15	41.7		
Smoking status			0	0.0
Smoker	7	18.9		
Non smoker	24	64.9		
Former smoker	6	16.2		
Time presence			0	0.0
<30 min	29	78.4		
>30 min	8	21.6		

Buffet de la Gare CFF

Questionnaires	56

Table 17

	Satisfied	Rather satisfied	Neither	Rather dis-satisfied	Dissatisfied	Total	Missing values	% missing values
Temperature	35	16	4	1	0	56	0	0.0
Draft	16	2	17	4	14	53	3	5.4
Humid	21	0	13	0	3	37	19	33.9
Fresh	8	12	14	3	0	37	19	33.9
Smoke	19	9	9	4	2	43	13	23.2
Noise	10	21	22	2	0	55	1	1.8
Odor	13	12	8	1	0	34	22	39.3
Odor quality	27	11	5	3	0	46	10	17.9
Accept (IAQ)	55			0		55	1	1.8
Environment	33	20	2	1	0	56	0	0.0

Table 18

	% satisfied	% rather satisfied	% neither	% rather dissatisfied	% dissatisfied	% total
Temperature	62.5	28.6	7.1	1.8	0.0	100
Draft	30.2	3.8	32.1	7.5	26.4	100
Humid	56.8	0.0	35.1	0.0	8.1	100
Fresh	21.6	32.4	37.8	8.1	0.0	100
Smoke	44.2	20.9	20.9	9.3	4.7	100
Noise	18.2	38.2	40.0	3.6	0.0	100
Odor	38.2	35.3	23.5	2.9	0.0	100
Odor quality	58.7	23.9	10.9	6.5	0.0	100
Accept (IAQ)	100.0			0.0		100
Environment	58.9	35.7	3.6	1.8	0.0	100

Table 19

	% dis-satisfied
Temperature	1.8
Draft	34.0
Humid	8.1
Fresh	8.1
Smoke	14.0
Noise	3.6
Odor	2.9
Odor quality	6.5
Accept (IAQ)	0.0
Environment	1.8

Table 20

	Count	%	Missing	% miss.
Gender			1	1.8
Male	40	72.7		
Female	15	27.3		
Age			1	1.8
<30	13	23.6		
30-49	29	52.7		
>50	13	23.6		
Smoking status			1	1.8
Smoker	24	43.6		
Non smoker	23	41.8		
Former smoker	8	14.5		
Time presence			2	3.6
<30 min	23	42.6		
>30 min	31	57.4		

La Maison du Prussien

Questionnaires	42

Table 21

	Satisfied	Rather satisfied	Neither	Rather dis-satisfied	Dissatisfied	Total	Missing values	% missing values
Temperature	22	8	8	3	0	41	1	2.4
Draft	6	4	12	3	15	40	2	4.8
Humid	20	1	8	0	3	32	10	23.8
Fresh	9	15	7	1	0	32	10	23.8
Smoke	19	9	9	4	2	43	-1	-2.4
Noise	6	22	11	2	0	41	1	2.4
Odor	21	11	2	1	0	35	7	16.7
Odor quality	25	9	2	1	0	37	5	11.9
Accept (IAQ)	41			1		42	0	0.0
Environment	31	6	3	0	0	40	2	4.8

Table 22

	% satisfied	% rather satisfied	% neither	% rather dissatisfied	% dissatisfied	% total
Temperature	53.7	19.5	19.5	7.3	0.0	100
Draft	15.0	10.0	30.0	7.5	37.5	100
Humid	62.5	3.1	25.0	0.0	9.4	100
Fresh	28.1	46.9	21.9	3.1	0.0	100
Smoke	44.2	20.9	20.9	9.3	4.7	100
Noise	14.6	53.7	26.8	4.9	0.0	100
Odor	60.0	31.4	5.7	2.9	0.0	100
Odor quality	67.6	24.3	5.4	2.7	0.0	100
Accept (IAQ)	97.6			2.4		100
Environment	77.5	15.0	7.5	0.0	0.0	100

Table 23

	% dis-satisfied
Temperature	7.3
Draft	45.0
Humid	9.4
Fresh	3.1
Smoke	14.0
Noise	4.9
Odor	2.9
Odor quality	2.7
Accept (IAQ)	2.4
Environment	0.0

Table 24

	Count	%	Missing	% miss.
Gender			0	0.0
Male	29	69.0		
Female	13	31.0		
Age			0	0.0
<30	12	28.6		
30-49	20	47.6		
>50	10	23.8		
Smoking status			0	0.0
Smoker	18	42.9		
Non smoker	20	47.6		
Former smoker	4	9.5		
Time presence			0	0.0
<30 min	22	52.4		
>30 min	20	47.6		

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Percent dissatisfied (Summary)						
Questionnaires	264	79	50	37	56	42

Table 25

	Study	Chalet Suisse	Relais Walker	Aub. Collines	Buffet G. CFF	M. Prussien
Temperature	3.9	2.6	6.1	2.8	1.8	7.3
Draft	38.5	42.7	20.5	51.4	34.0	45.0
Humid	12.0	9.3	23.5	13.6	8.1	9.4
Fresh	15.8	35.6	22.9	0.0	8.1	3.1
Smoke	14.2	20.5	17.1	11.1	14.0	14.0
Noise	15.8	31.2	12.2	18.9	3.6	4.9
Odor	11.2	18.4	13.5	8.3	2.9	2.9
Odor quality	19.1	47.4	2.8	6.7	6.5	2.7
Accept (IAQ)	3.1	6.3	0.0	5.9	0.0	2.4
Environment	2.7	6.4	0.0	2.7	1.8	0.0

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Numeric values
Means of Air characteristics vs Clients characteristics

Table 26: Restaurants

	Total	Chalet Suisse	Relais Walker	Aub. Collines	Buffet G. CFF	M. Prussien
Temperature	1.56	1.55	1.59	1.39	1.48	1.80
Draft	2.94	2.69	2.36	3.63	2.96	3.43
Humid	2.08	2.00	2.56	1.91	2.03	1.91
Fresh	2.55	3.08	2.28	2.41	2.32	2.00
Smoke	2.16	2.32	2.37	2.22	2.09	1.62
Noise	2.39	2.66	2.20	2.43	2.29	2.22
Odor	2.04	2.47	1.92	1.79	1.91	1.51
Odor quality	2.16	3.11	1.89	1.80	1.65	1.43
Accept (IAQ)						
Environment	1.62	1.99	1.56	1.51	1.48	1.30

Table 27: Gender

	Total	Male	Female
Temperature	1.56	1.59	1.46
Draft	2.94	2.92	3.00
Humid	2.08	2.09	2.00
Fresh	2.55	2.49	2.62
Smoke	2.16	2.19	2.09
Noise	2.39	2.44	2.28
Odor	2.04	1.96	2.19
Odor quality	2.16	2.01	2.53
Accept (IAQ)			
Environment	1.62	1.59	1.70

Table 28: Smoking status

	Total	Smoker	Non smoker	Former smok.
Temperature	1.56	1.70	1.52	1.31
Draft	2.94	2.73	3.09	3.00
Humid	2.08	2.04	2.03	2.38
Fresh	2.55	2.71	2.47	2.31
Smoke	2.16	2.29	2.11	1.91
Noise	2.39	2.52	2.37	2.11
Odor	2.04	2.31	1.87	1.88
Odor quality	2.16	2.48	1.93	2.04
Accept (IAQ)				
Environment	1.62	1.79	1.55	1.40

Numeric values
Means of Air characteristics vs Clients characteristics

Table 29: Age

	Total	<30	30-49	>=50
Temperature	2.94	2.86	2.81	3.25
Draft	2.08	1.93	2.00	2.30
Humid	2.55	2.93	2.52	2.30
Fresh	2.16	2.07	2.35	1.84
Smoke	2.39	2.38	2.58	2.07
Noise	2.04	1.89	2.29	1.70
Odor	2.16	2.22	2.43	1.59
Odor quality				
Accept (IAQ)	1.62	1.62	1.78	1.35
Environment	1.62	1.99	1.56	1.51

Table 30: Time presence

	Total	<30 min	>=30 min
Temperature	1.56	1.52	1.58
Draft	2.94	3.15	2.81
Humid	2.08	1.99	2.13
Fresh	2.55	2.35	2.65
Smoke	2.16	1.98	2.27
Noise	2.39	2.32	2.44
Odor	2.04	1.92	2.10
Odor quality	2.16	1.87	2.37
Accept (IAQ)			
Environment	1.62	1.50	1.71

Contingency tables
Air characteristics vs Clients characteristics

Table 31

Chi-square test (5 values; IAQ: 2 values)					
	Restaurant	Gender	Age	Smoking status	Time presence
Temperature	***	=	**	=	=
Draft	***	**	*	=	*
Humid	***	**	*	=	=
Fresh	***	=	**	=	*
Smoke	=	=	=	=	=
Noise	***	=	***	***	**
Odor	***	=	***	***	=
Odor quality	***	**	**	=	**
Accept (IAQ)	=	=	=	=	=
Environment	***	=	***	**	=

Table 32

Chi-square test (2 values)					
	Restaurant	Gender	Age	Smoking status	Time presence
Temperature	=	=	=	=	=
Draft	**	=	*	=	=
Humid	=	=	**	=	=
Fresh	***	=	=	=	**
Smoke	*	=	=	=	*
Noise	***	=	*	=	*
Odor	*	=	=	=	=
Odor quality	***	***	***	**	***
Accept (IAQ)	=	=	=	=	=
Environment	=	=	=	=	=

Legend

p value	Sign. Level	Symbol
p <=0.01	99%	***
0.01 < p <=0.05	95%	**
0.05 < p <=0.10	90%	*
0.10 < P	not significant	=

ANOVA

Air characteristics vs Clients characteristics

Table 33

F test					
	Restaurant	Gender	Age	Smoking status	Time presence
Temperature	=	=	**	*	=
Draft	***	=	=	=	*
Humid	=	=	=	=	=
Fresh	***	=	**	=	*
Smoke	**	=	**	=	*
Noise	=	=	**	=	=
Odor	***	=	***	**	=
Odor quality	***	***	***	**	***
Accept (IAQ)	=	=	=	=	=
Environment	***	=	***	**	**

Table 34

Kruskal-Wallis test					
	Restaurant	Gender	Age	Smoking status	Time presence
Temperature	=	=	***	*	=
Draft	***	=	=	=	*
Humid	=	=	=	=	=
Fresh	***	=	**	=	=
Smoke	**	=	**	=	=
Noise	=	=	***	=	=
Odor	***	=	***	***	=
Odor quality	***	**	***	**	**
Accept (IAQ)	=	=	=	=	=
Environment	***	=	***	**	**

Legend

p value	Sign. Level	Symbol
p <=0.01	99%	***
0.01 < p <=0.05	95%	**
0.05 < p <=0.10	90%	*
0.10 < P	not significant	=

Correlation coefficient (contingency tables)

Air characteristics vs Clients characteristics

Table 35: Temperature

Correlation coefficient (5 values; IAQ 2 values)						
	Total	Chalet Suisse	Relais Walker	Aub. Collines	Buffet G. CFF	M. Prussien
Draft	=	***	=	***	=	=
Humid	=	*	=	=	=	=
Fresh	=	=	***	*	***	=
Smoke	=	=	**	=	**	=
Noise	***	=	***	=	*	=
Odor	***	*	***	=	=	=
Odor quality	*	=	*	=	*	=
Accept (IAQ)	=	=	=	=	=	=
Environment	***	=	***	*	**	*

Table 36: Draft

Correlation coefficient (5 values; IAQ 2 values)						
	Total	Chalet Suisse	Relais Walker	Aub. Collines	Buffet G. CFF	M. Prussien
Temperature	=	***	=	***	=	=
Humid	***	***	*	=	=	=
Fresh	***	***	**	=	**	=
Smoke	***	=	=	*	**	***
Noise	***	=	**	**	***	***
Odor	=	=	=	**	***	=
Odor quality	**	=	**	*	=	=
Accept (IAQ)	=	=	=	=	=	=
Environment	***	=	=	**	=	**

Table 37: Humidity

Correlation coefficient (5 values; IAQ 2 values)						
	Total	Chalet Suisse	Relais Walker	Aub. Collines	Buffet G. CFF	M. Prussien
Temperature	=	*	=	=	=	=
Draft	***	***	*	=	=	=
Fresh	=	***	=	=	=	=
Smoke	**	***	=	=	=	=
Noise	=	***	=	*	=	**
Odor	=	=	=	=	=	=
Odor quality	=	=	**	=	=	=
Accept (IAQ)	=	=	=	=	=	=
Environment	=	=	=	=	=	=

Legend

p value	Sign. Level	Symbol
p <=0.01	99%	***
0.01 < p <=0.05	95%	**
0.05 < p <=0.10	90%	*
0.10 < P	not significant	=

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Contingency coefficient (contingency tables)

Air characteristics vs Clients characteristics

Table 38: Fresh

Correlation coefficient (5 values; IAQ 2 values)						
	Total	Chalet Suisse	Relais Walker	Aub. Collines	Buffet G. CFF	M. Prussien
Temperature	=	=	***	*	***	=
Draft	***	***	**	=	**	=
Humid	=	***	**	=	=	=
Smoke	***	=	***	***	***	**
Noise	=	***	***	**	***	=
Odor	***	=	***	=	***	*
Odor quality	***	*	***	=	=	**
Accept (IAQ)	=	=	=	=	=	=
Environment	***	***	***	*	**	=

Table 39: Smoke

Correlation coefficient (5 values; IAQ 2 values)						
	Total	Chalet Suisse	Relais Walker	Aub. Collines	Buffet G. CFF	M. Prussien
Temperature	=	=	**	=	**	=
Draft	***	=	=	*	**	***
Humid	**	***	=	=	=	=
Fresh	***	=	***	***	***	**
Noise	***	***	**	**	=	**
Odor	***	*	***	*	=	*
Odor quality	***	=	**	**	**	*
Accept (IAQ)	**	*	=	=	=	=
Environment	***	**	***	*	***	=

Table 40: Noise

Correlation coefficient (5 values; IAQ 2 values)						
	Total	Chalet Suisse	Relais Walker	Aub. Collines	Buffet G. CFF	M. Prussien
Temperature	***	=	***	=	*	*
Draft	***	=	**	**	***	***
Humid	=	=	=	*	=	**
Fresh	=	***	***	***	**	=
Smoke	***	***	**	**	=	**
Odor	***	*	**	=	***	***
Odor quality	***	=	=	*	***	=
Accept (IAQ)	**	**	=	=	=	=
Environment	***	*	**	*	***	***

Legend

p value	Sign. Level	Symbol
p <=0.01	99%	***
0.01 < p <=0.05	95%	**
0.05 < p <=0.10	90%	*
0.10 < P	not significant	=

PM3006517115

Contingency coefficient (contingency tables)

Air characteristics vs Clients characteristics

Table 41: Odor

Correlation coefficient (5 values; IAQ 2 values)						
	Total	Chalet Suisse	Relais Walker	Aub. Collines	Buffet G. CFF	M. Prussien
Temperature	***	*	***	=	=	=
Draft	=	=	=	***	***	=
Humid	=	=	=	=	=	*
Fresh	***	=	***	=	***	*
Smoke	***	*	***	*	=	*
Noise	***	*	**	=	***	***
Odor quality	***	***	*	=	***	*
Accept (IAQ)	*	**	=	=	=	=
Environment	***	***	***	=	**	=

Table 42: Odor quality

Correlation coefficient (5 values; IAQ 2 values)						
	Total	Chalet Suisse	Relais Walker	Aub. Collines	Buffet G. CFF	M. Prussien
Temperature	*	*	**	=	*	=
Draft	**	=	**	*	=	=
Humid	=	=	**	=	=	=
Fresh	***	=	***	=	=	**
Smoke	***	=	**	**	**	*
Noise	***	=	=	*	***	=
Odor	***	***	*	=	***	*
Accept (IAQ)	**	**	=	=	=	=
Environment	***	***	**	=	**	=

Table 43: Environment

Correlation coefficient (5 values; IAQ 2 values)						
	Total	Chalet Suisse	Relais Walker	Aub. Collines	Buffet G. CFF	M. Prussien
Temperature	***	=	***	*	**	*
Draft	**	=	=	**	=	**
Humid	=	=	=	=	=	=
Fresh	***	***	**	*	**	=
Smoke	***	**	***	*	***	=
Noise	***	=	**	*	***	*
Odor	***	***	***	=	**	=
Odor quality	***	***	**	=	**	=
Accept (IAQ)	**	**	=	=	=	=

Legend

p value	Sign. Level	Symbol
p <=0.01	99%	***
0.01 < p <=0.05	95%	**
0.05 < p <=0.10	90%	*
0.10 < P	not significant	=

Contingency coefficient (contingency tables)

Air characteristics vs Clients characteristics

Table 44: Accept (IAQ)

Correlation coefficient (5 values; IAQ 2 values)						
	Total	Chalet Suisse	Relais Walker	Aub. Collines	Buffet G. CFF	M. Prussien
Temperature	=	=	=	=	=	=
Draft	=	=	=	=	=	=
Humid	=	=	=	=	=	=
Fresh	=	=	=	=	=	=
Smoke	**	*	=	=	=	=
Noise	**	**	=	=	=	=
Odor	**	**	=	=	=	=
Odor quality	**	**	=	=	=	=
Environment	**	**	=	=	=	=

Fig. 1: Percents for temperature in the 5 restaurants

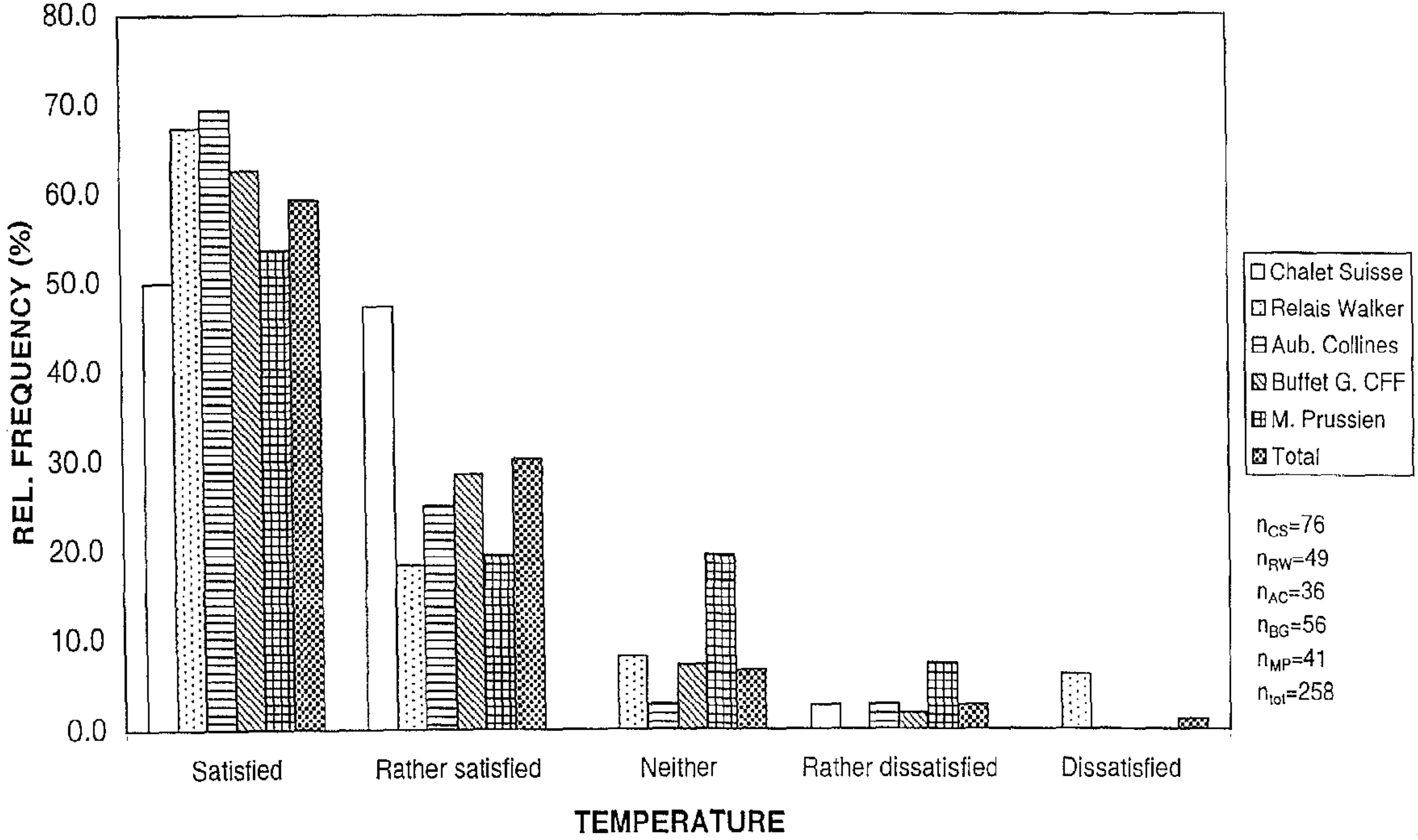

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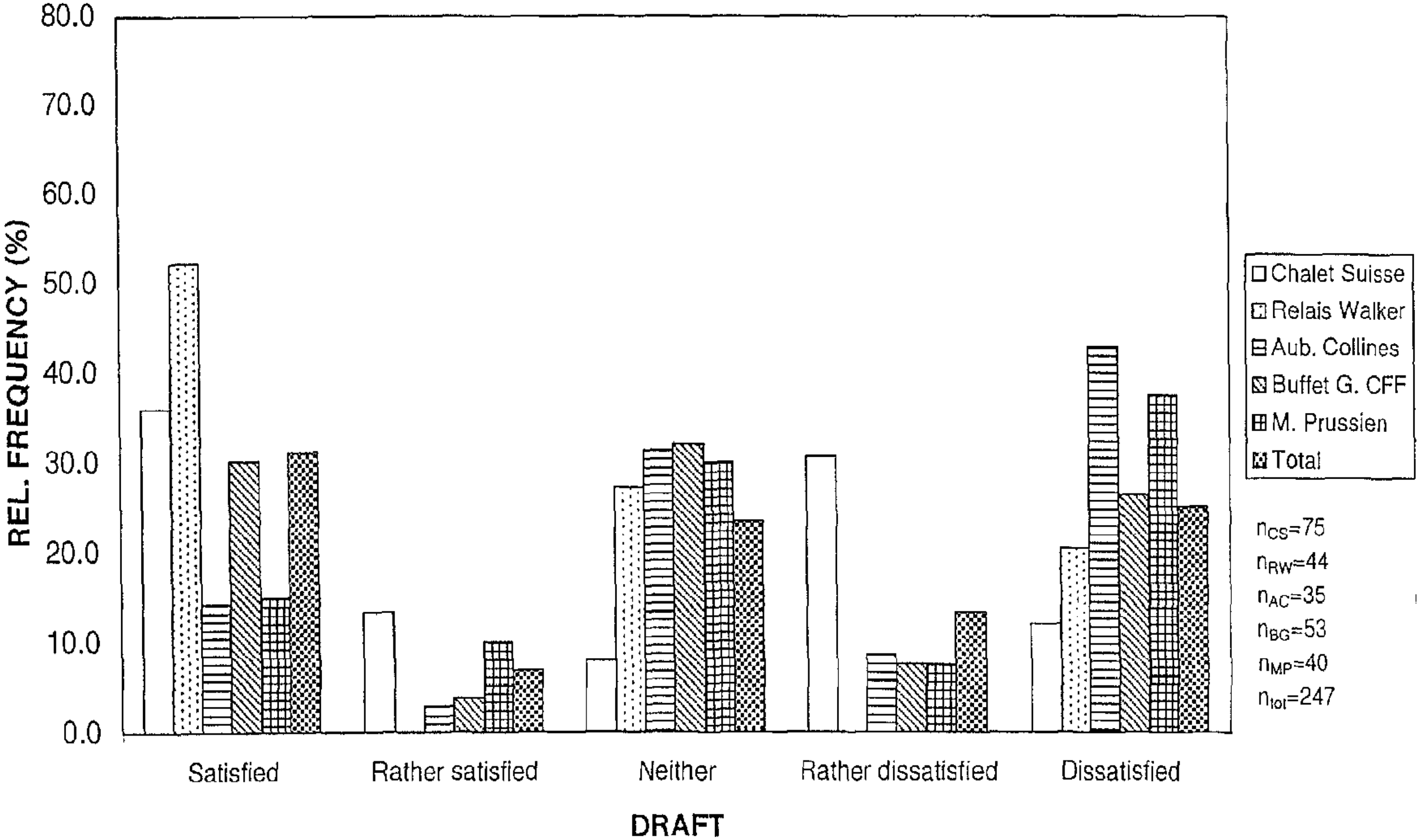
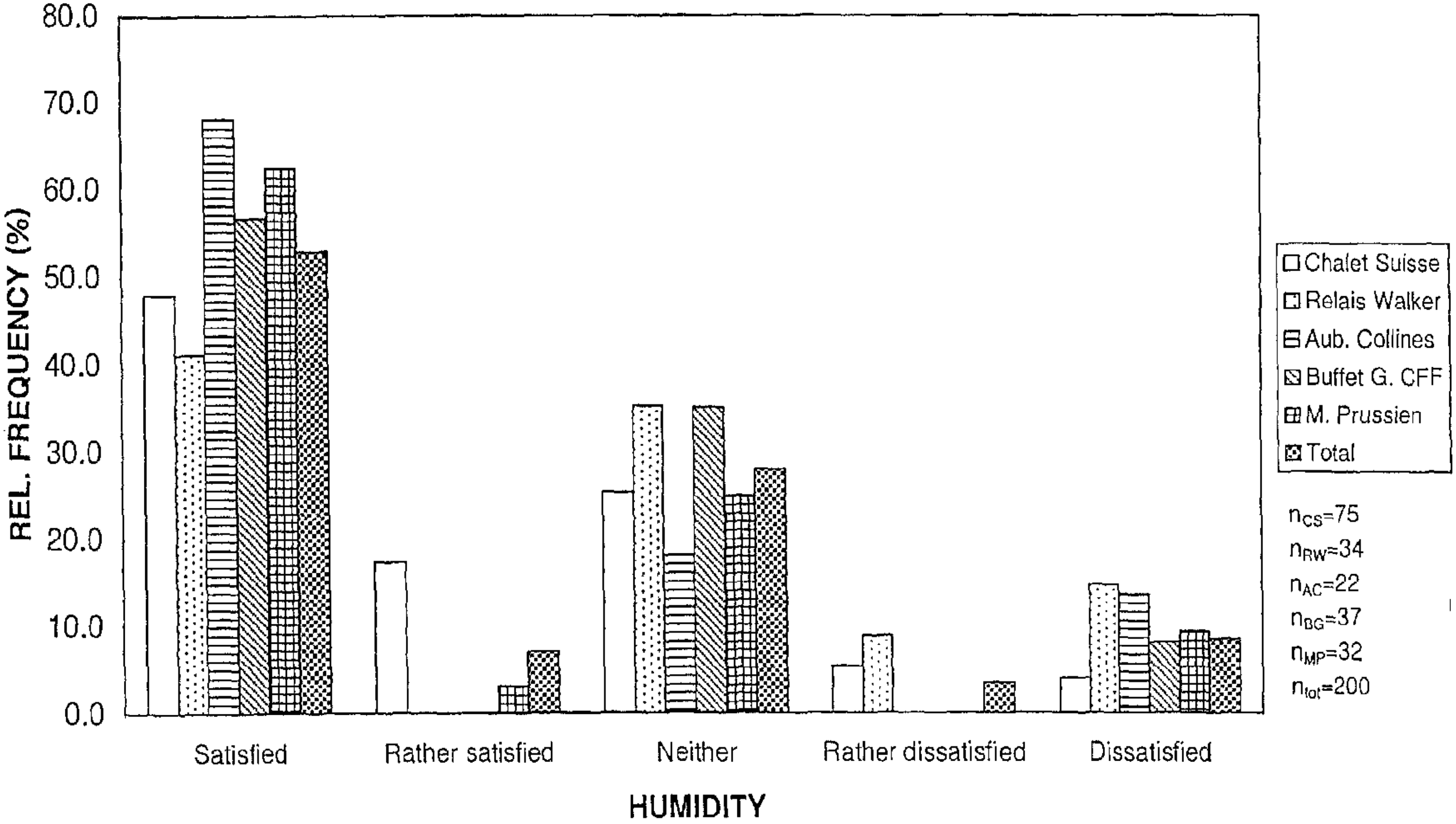
Fig. 2: Percents for draft in the 5 restaurants



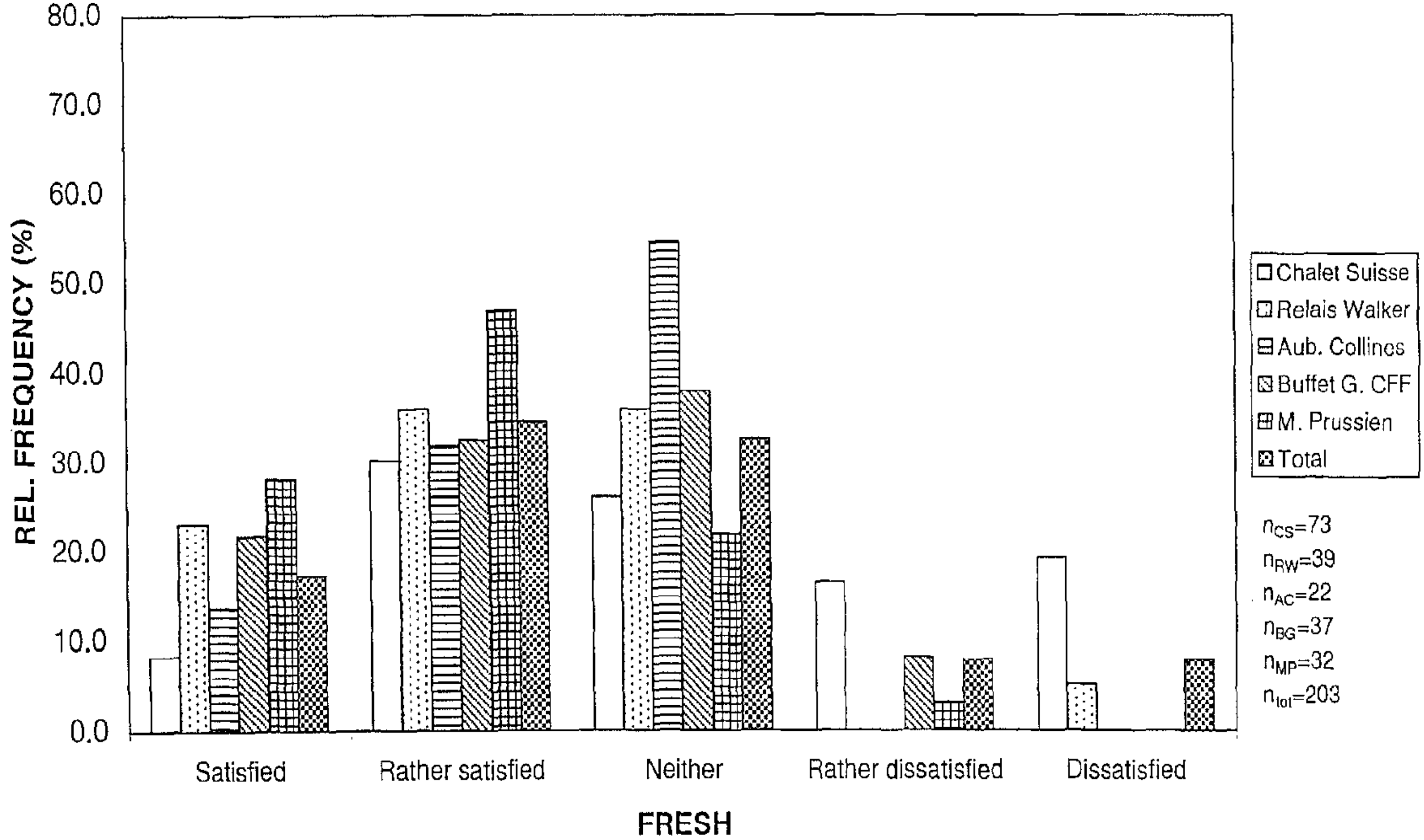
PM3006517119

Fig. 3: Percents for humidity in the 5 restaurants



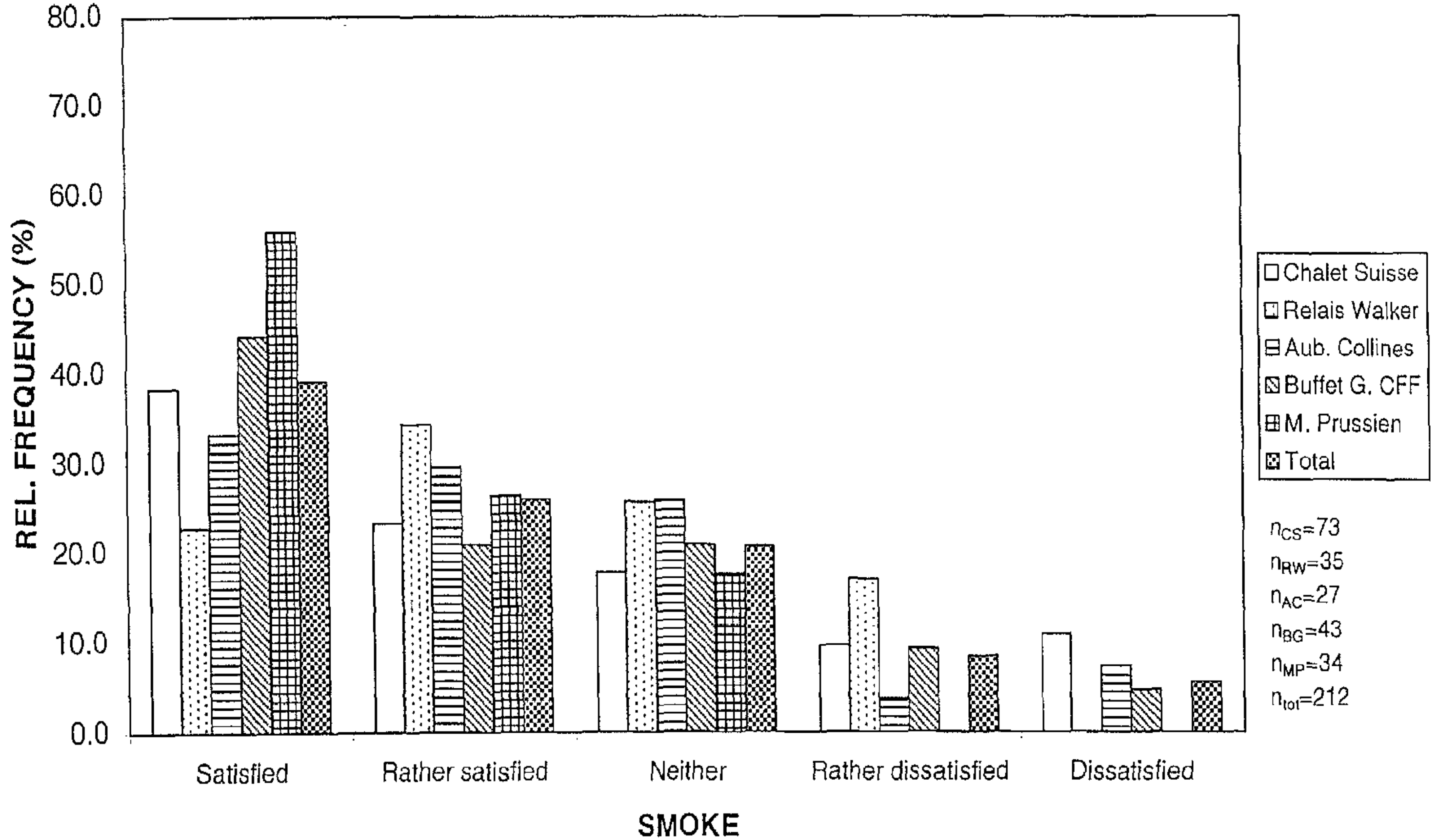
PM3006517120

Fig. 4: Percents for fresh in the 5 restaurants



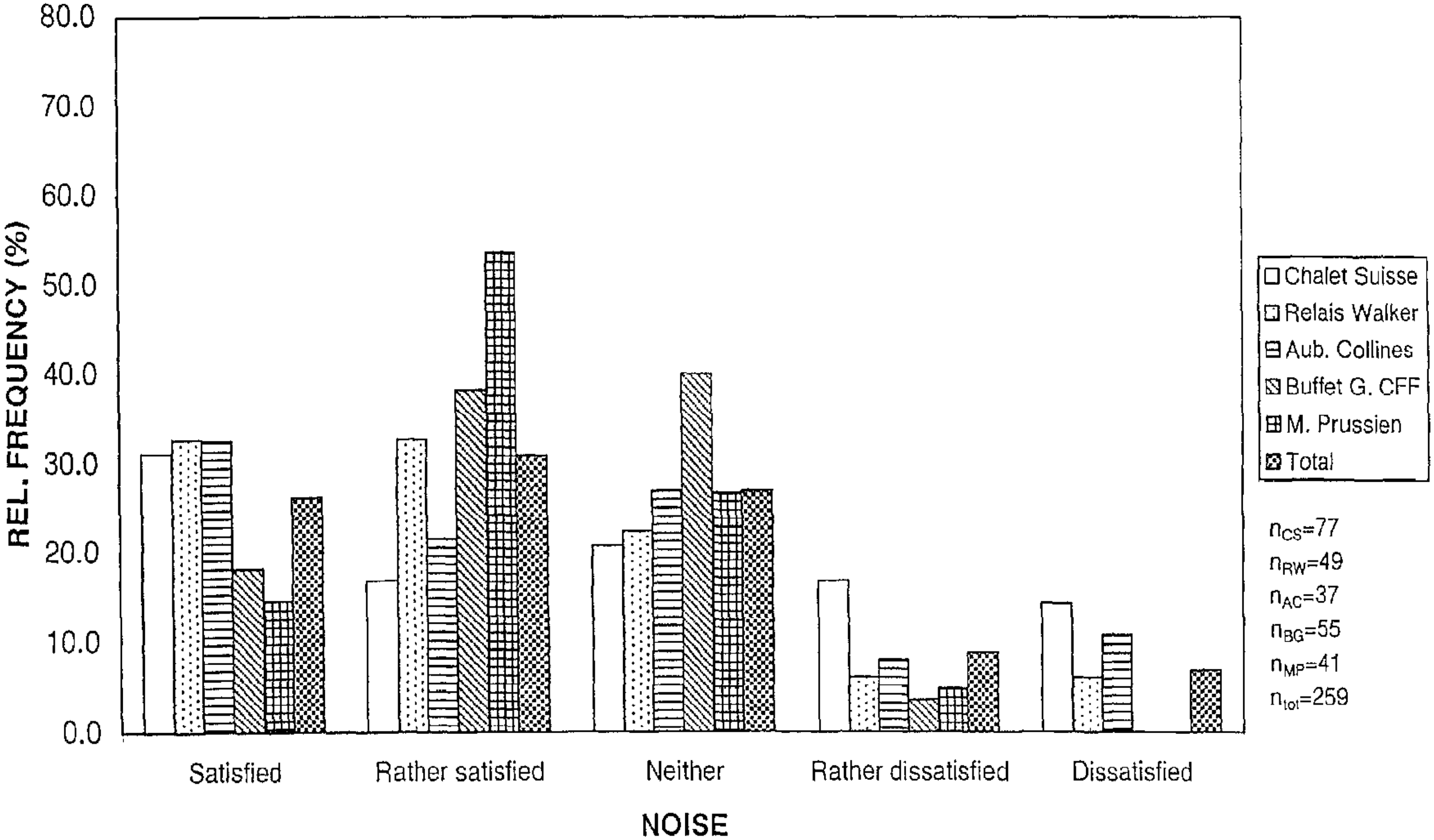
PM3006517121

Fig. 5: Percents for smoke in the 5 restaurants



PM3006517122

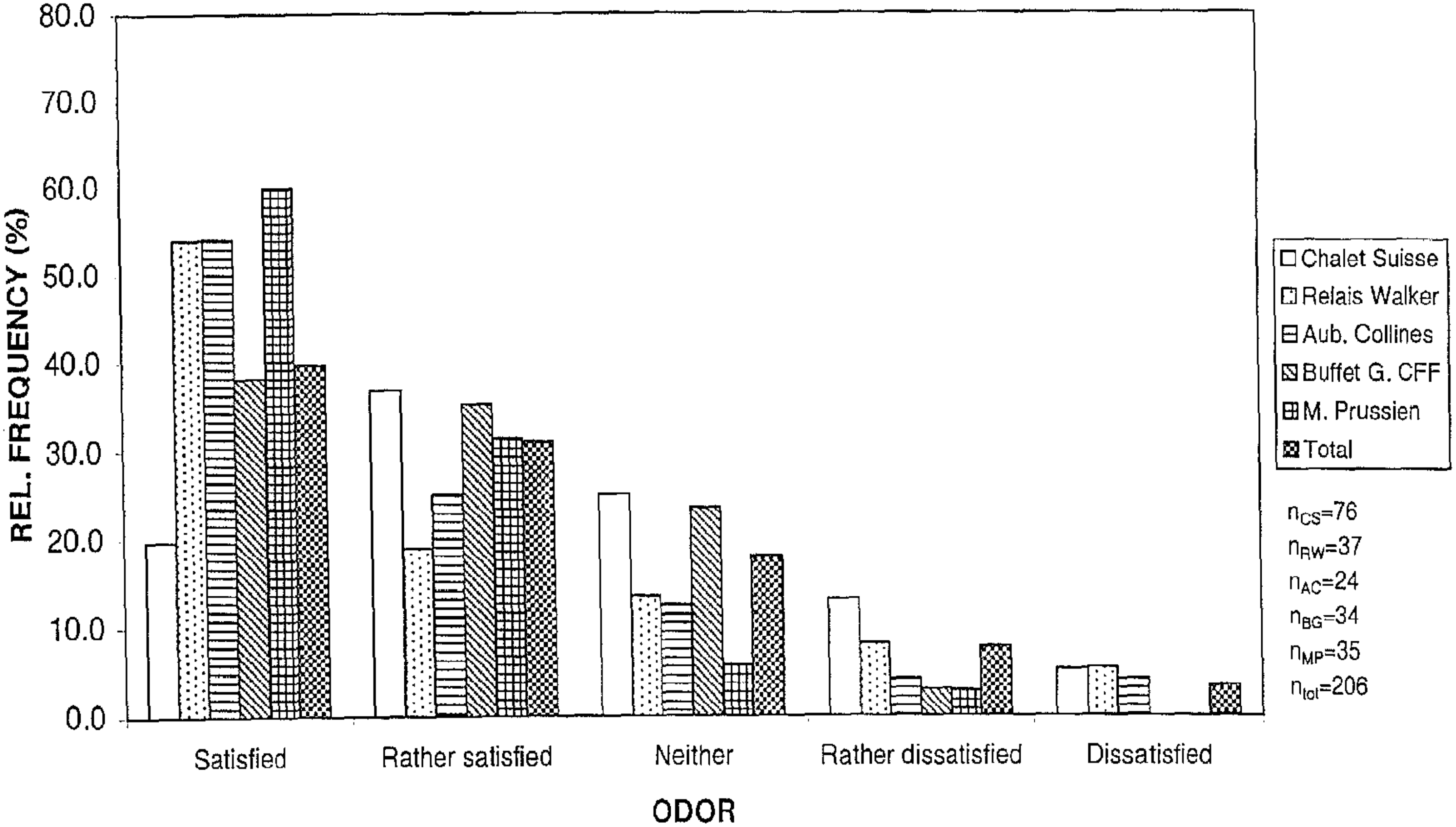
Fig. 6: Percents for noise in the 5 restaurants



$n_{CS}=77$
$n_{RW}=49$
$n_{AC}=37$
$n_{BG}=55$
$n_{MP}=41$
$n_{tot}=259$

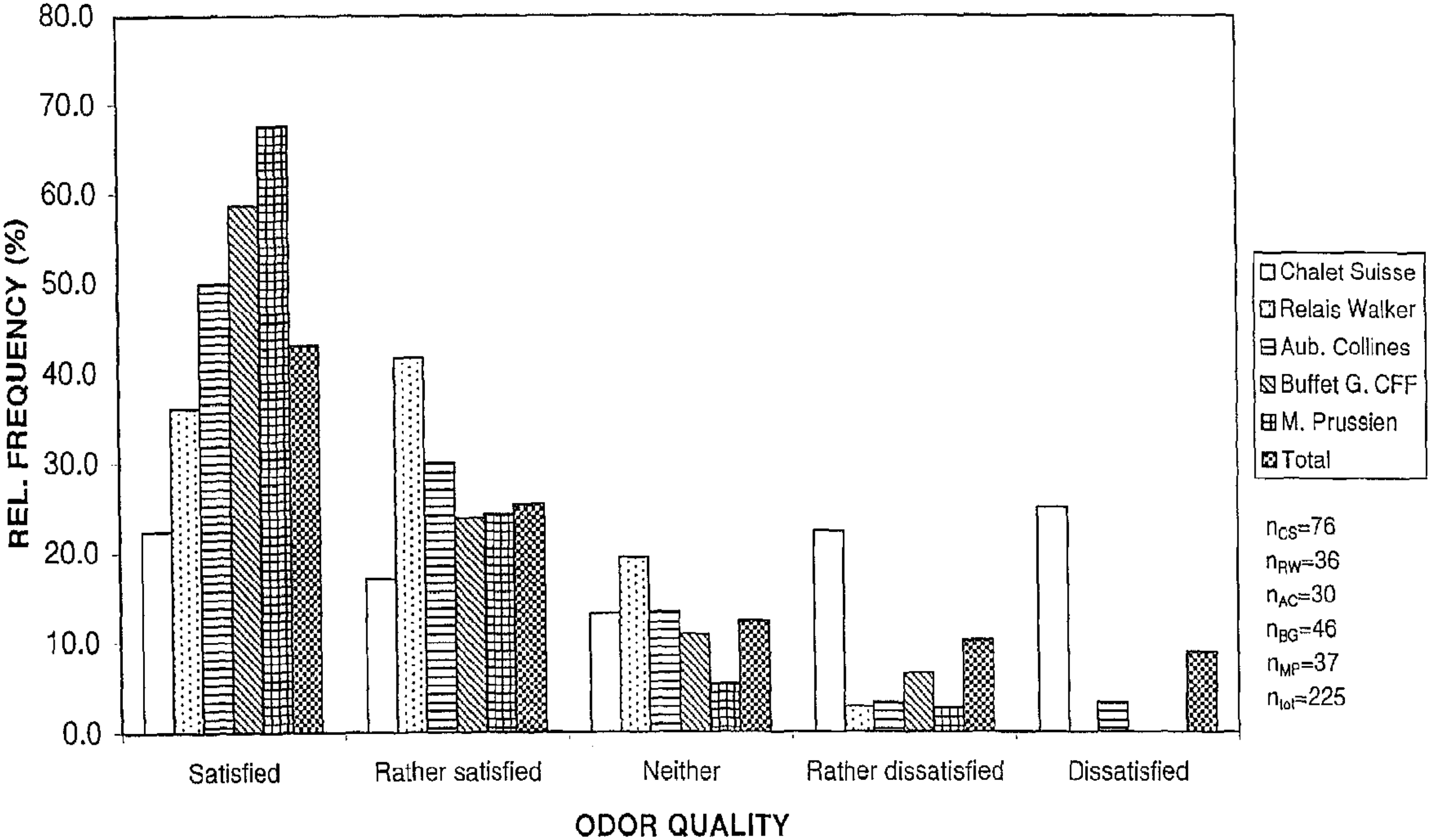
PM3006517123

Fig. 7: Percents for odor in the 5 restaurants



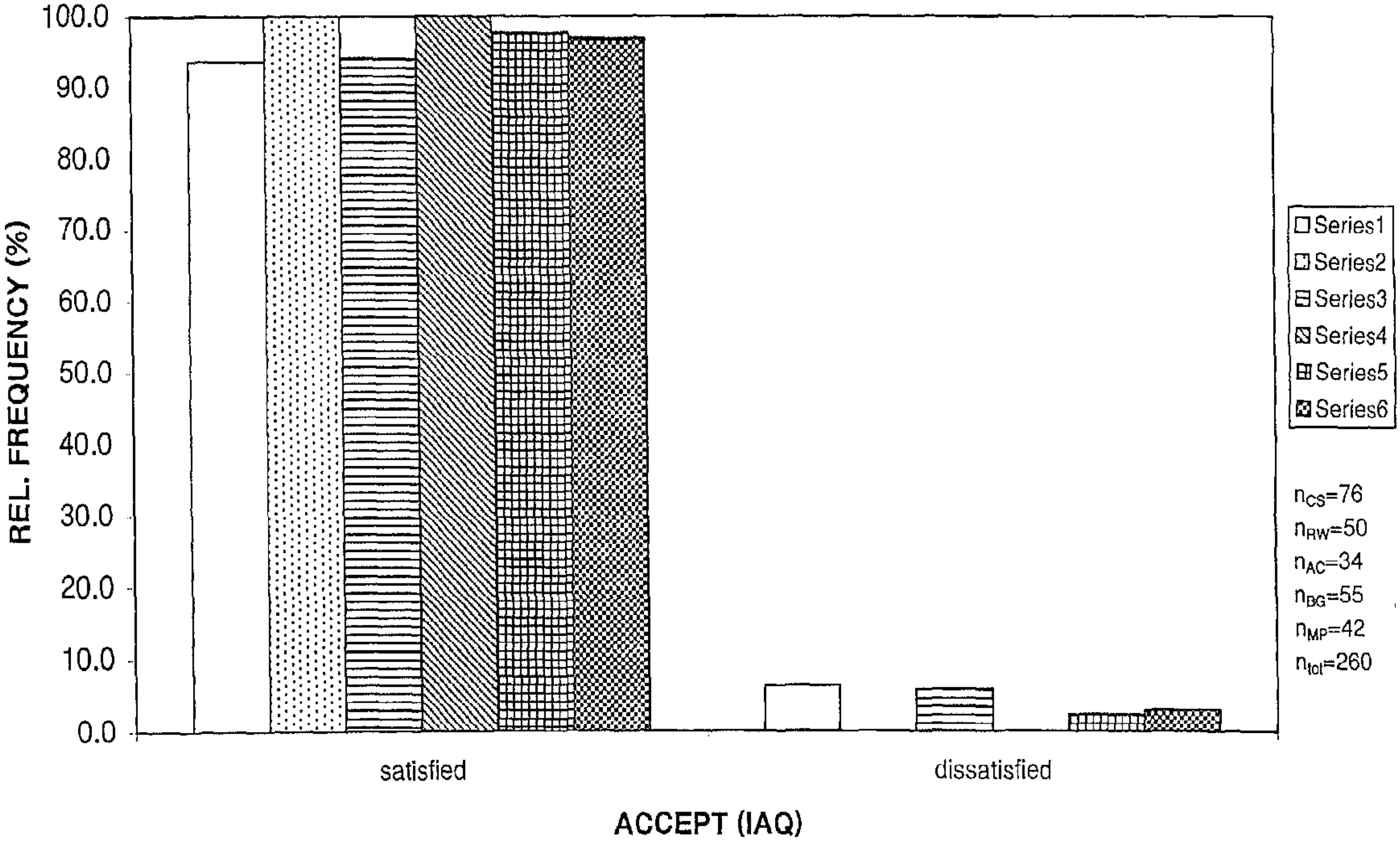
PM3006517124

Fig. 8: Percents for odor quality in the 5 restaurants



PM3006517125

Fig. 9: Percents for acceptibility (IAQ) in the 5 restaurants



PM3006517126

Fig. 10: Percents for environment in the 5 restaurants

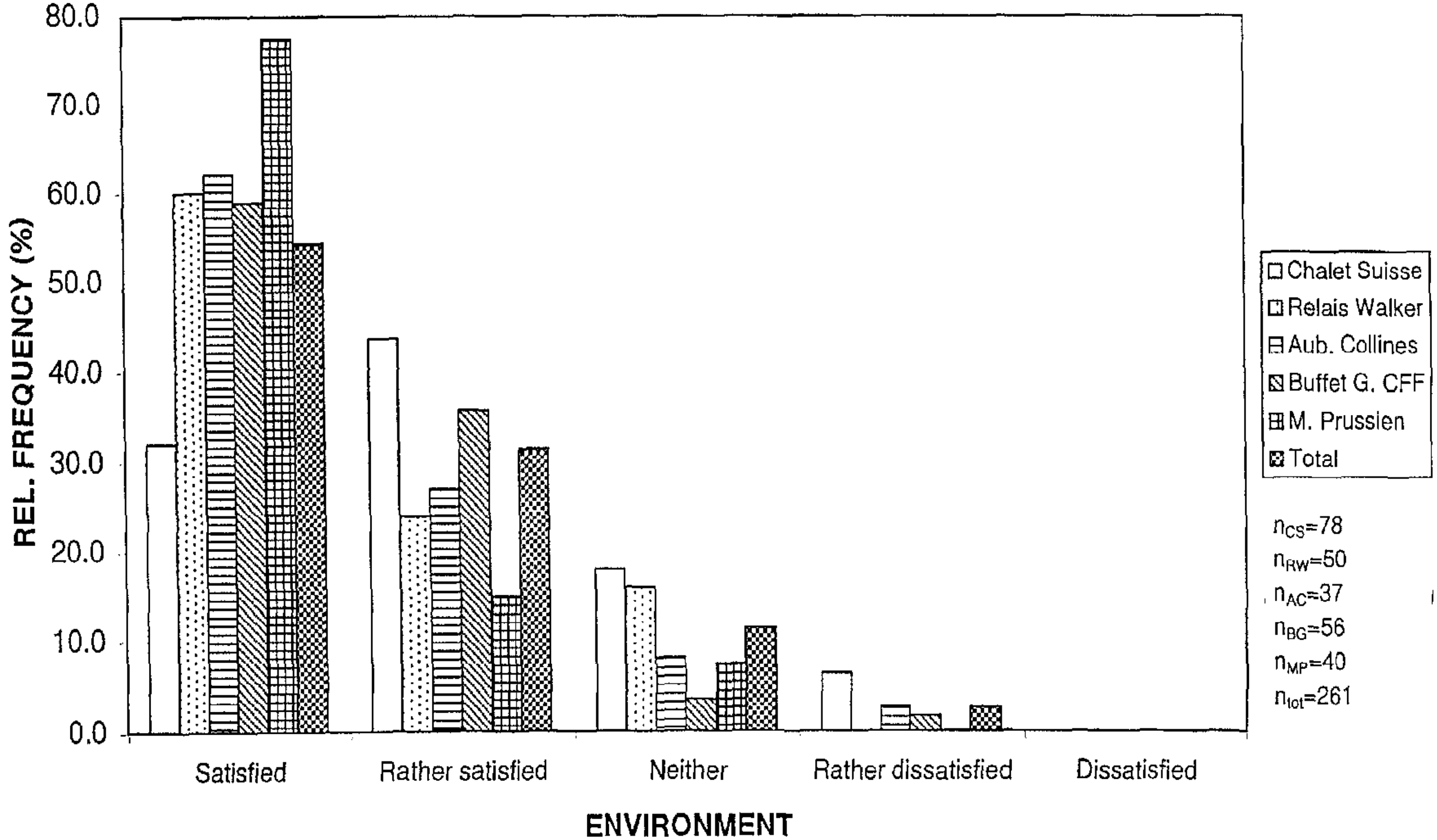


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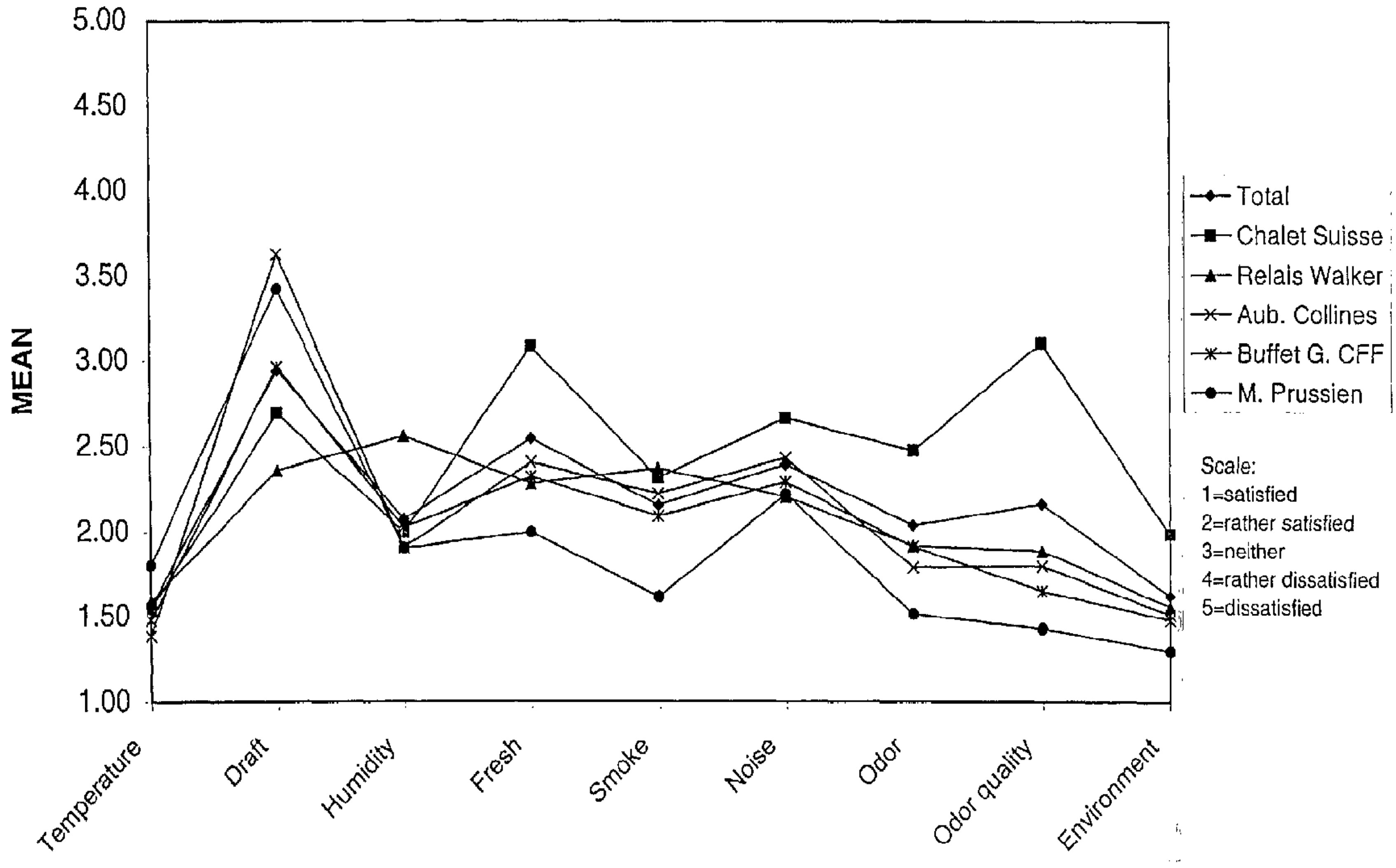
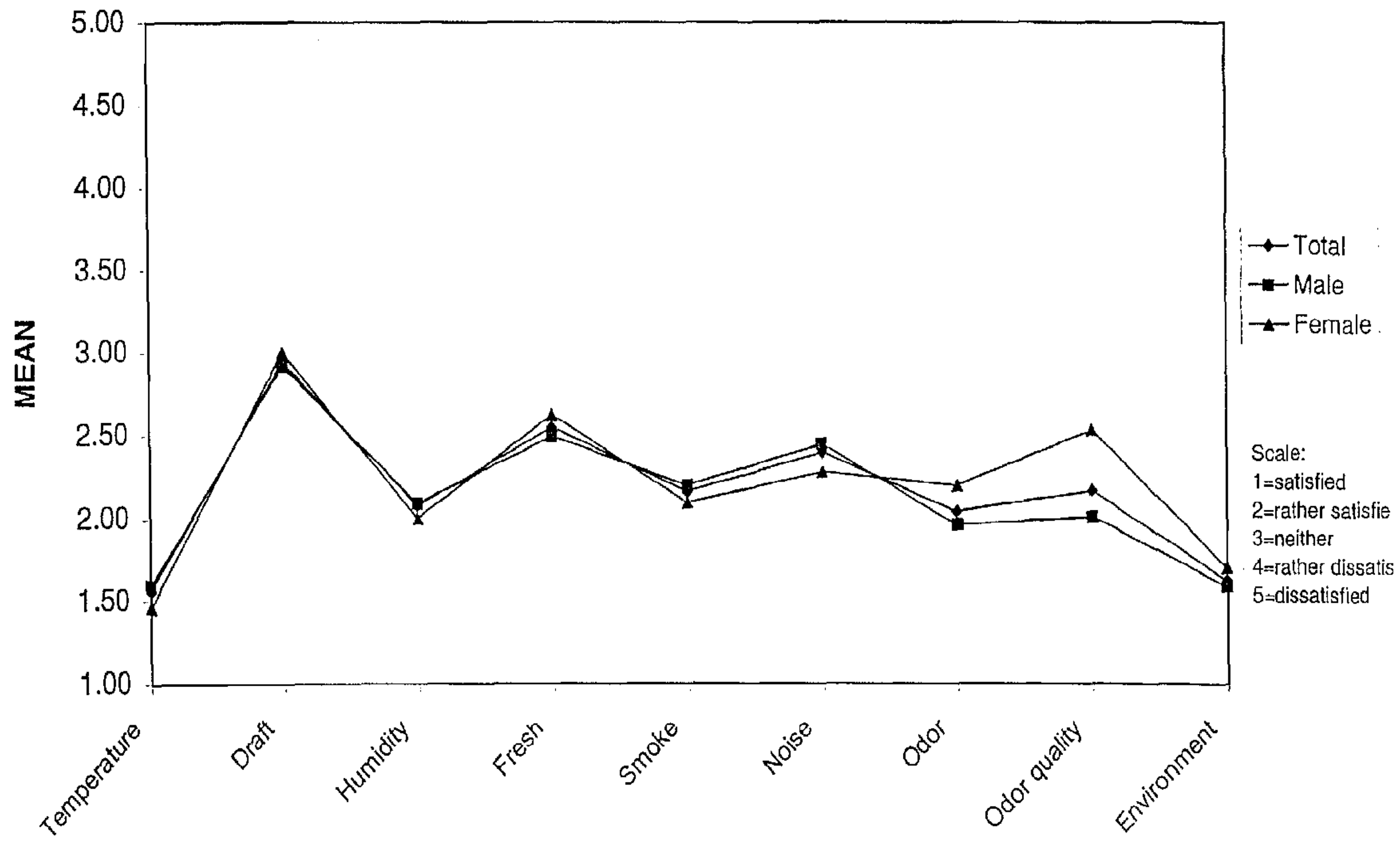
Fig. 11: Air characteristics vs Restaurants



PME facvccp.xls Chart 1

PM3006517128

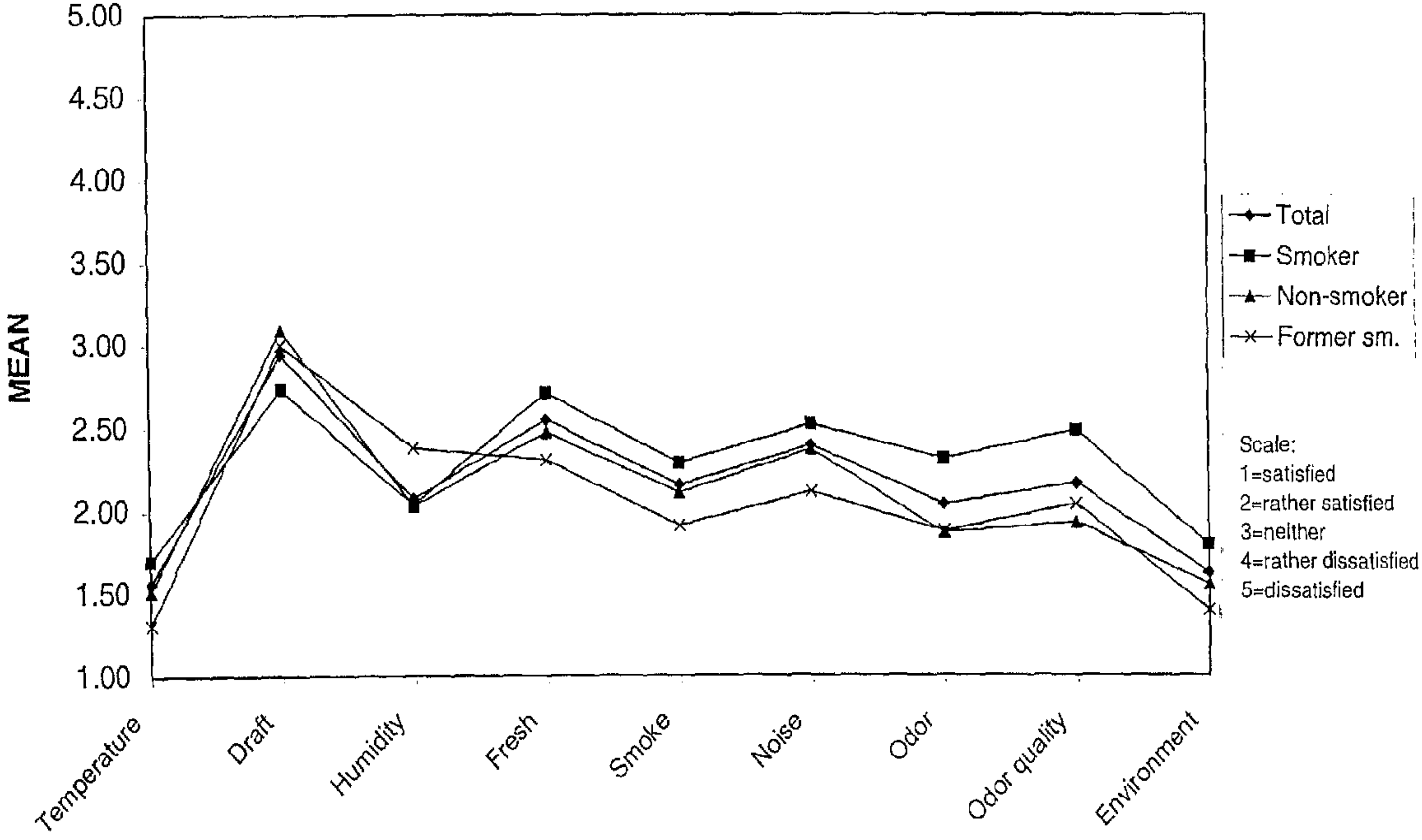
Fig. 12: Air characteristics vs Gender



PME facvccp.xls Chart 2

PM3006517129

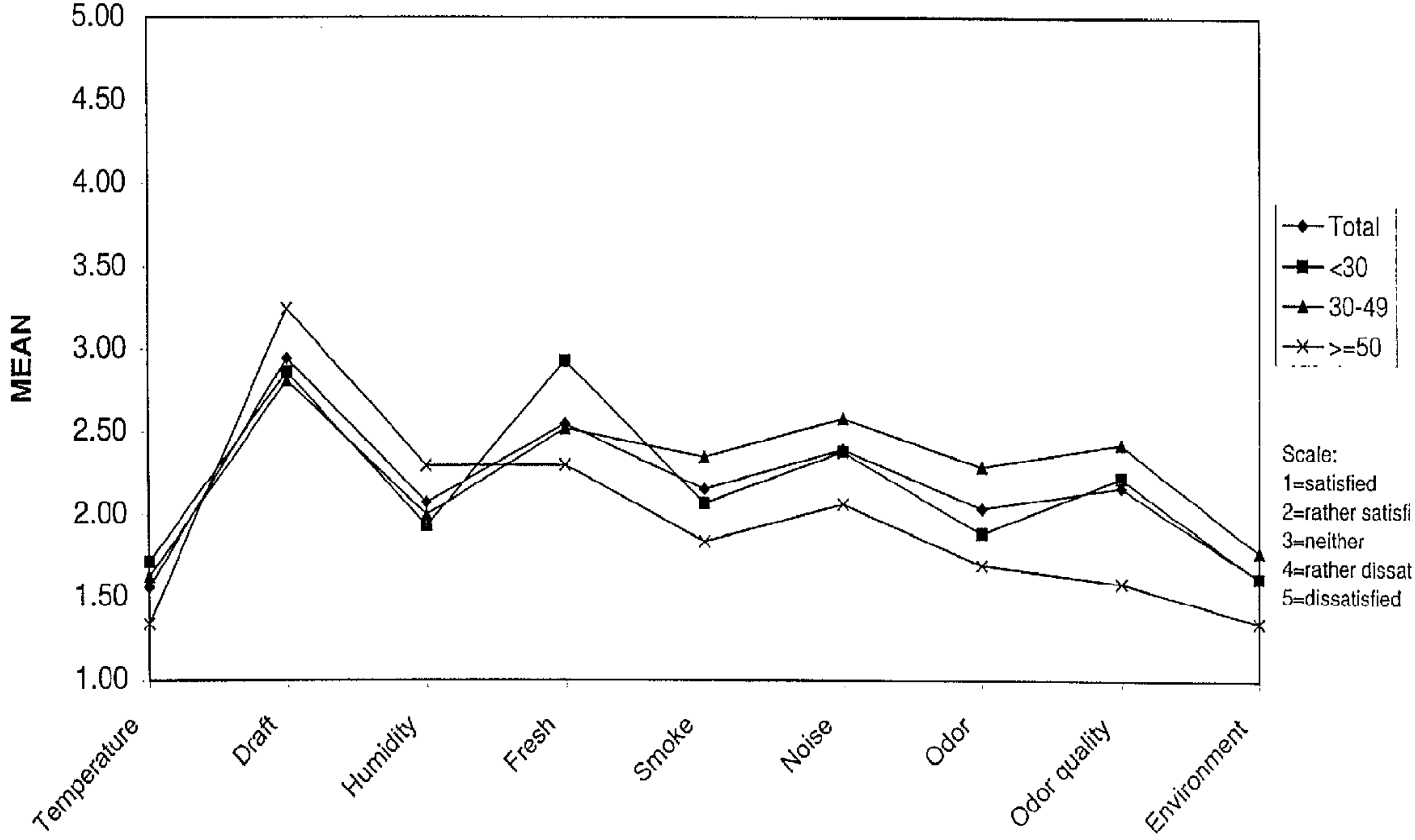
Fig. 13: Air characteristics vs Smoking status



PME facvccp.xls Chart 3

PM3006517130

Fig. 14: Air characteristics vs Age



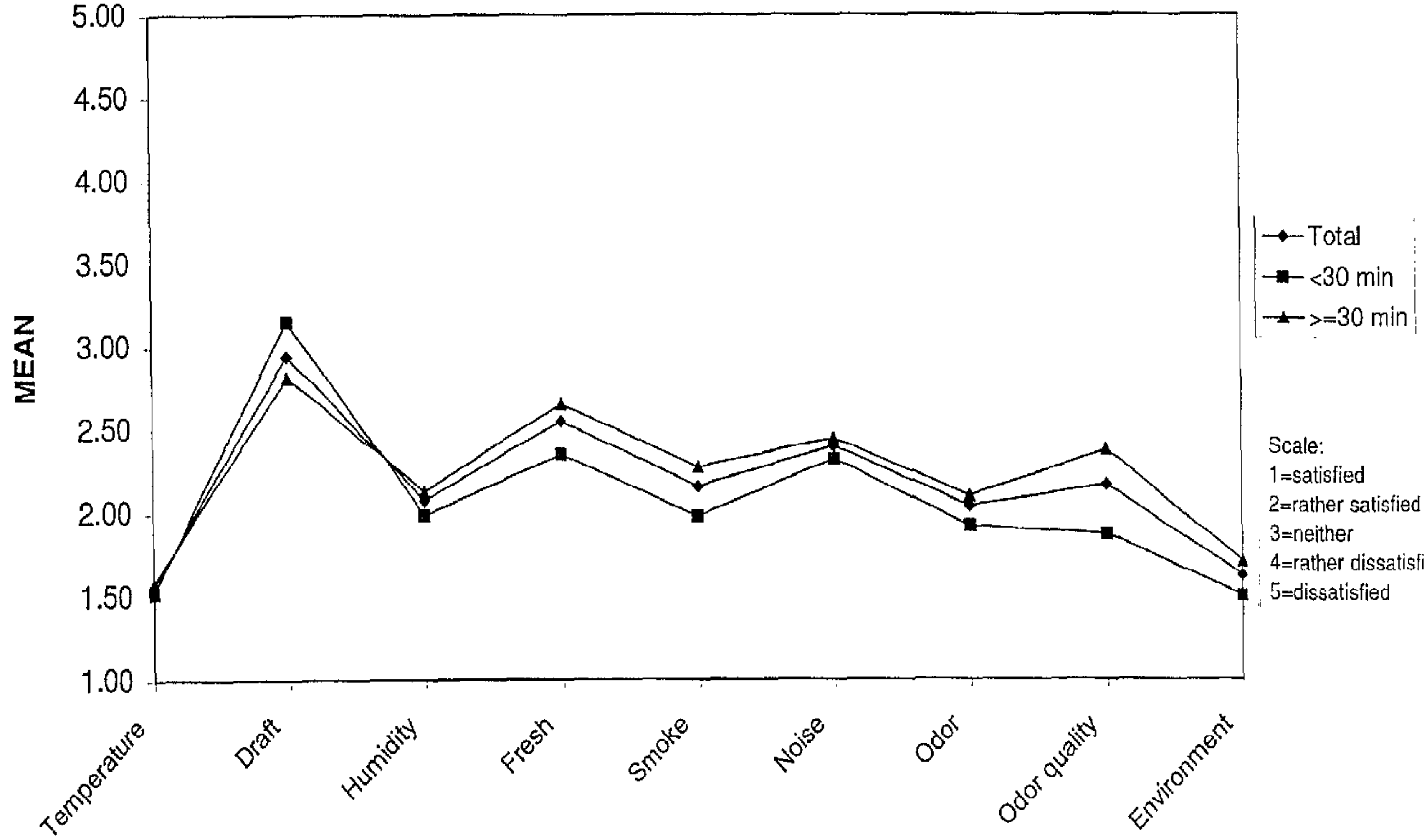
PME

facvccp.xls

Chart 4

PM3006517131

Fig. 15: Air characteristics vs Time presence



PME facvccp.xls Chart 5

PM3006517132

APPENDIX III: Questionnaire

SVP, un formulaire par personne.

QUESTIONNAIRE RESTAURANT

Date |__|__|__|__|__|__|

Heure |___|___| Table Nr. |__|

1. **Votre tranche d'â-ge** moins de 30 (_)
   30-49 (_)
   plus de 50 (_)

2. **Vous êtes...** ...une femme (_)
   ...un homme (_)

3. **Fumez vous?** Oui (_)
   Non (_)
   Plus maintenant, mais régulièrement dans le passé (_)

4. **Depuis combien de temps êtes vous arrivé(e) dans ce restaurant?**
   Moins de 30 min. (_)
   Plus de 30 min. (_)

5. **Comment jugeriez-vous en cet instant la qualité de l'air?**
   (_)....*tout à fait acceptable*
   (_)
   (_)
   (_)
   (_)....*à peu près acceptable*

   (_)....*pas tout à fait acceptable*
   (_)
   (_)
   (_)
   (_)....*totalement inacceptable*

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6. Comment jugeriez vous en cet instant les conditions dans la pièce et son environnement climatique?

Température

confortable	❑	❑	❑	❑	❑	*inconfortable*

Mouvements d'air

air immobile	❑	❑	❑	❑	❑	*courants d'air*

Air ambiant

trop sec	❑	❑	❑	❑	❑	*trop humide*
frais	❑	❑	❑	❑	❑	*étouffant*
clair	❑	❑	❑	❑	❑	*enfumé*

Odeur

pas d'odeur	❑	❑	❑	❑	❑	*très forte odeur*
agréable	❑	❑	❑	❑	❑	*désagréable*

Bruit

aucun bruit	❑	❑	❑	❑	❑	*trop de bruit*

Au total les conditions d'ambiance sont

satisfaisantes	❑	❑	❑	❑	❑	*non-satisfaisantes*

7. Si ce n'est pas votre première visite, par rapport a votre expérience précédente, diriez-vous que ces conditions sont

❑ meilleures ❑ identiques ❑ pires ❑ ne sais pas

♥♥♥♥♥♥ MERCI BEAUCOUP ♥♥♥♥♥♥

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RESTAURANT TEST PROTOCOL

13. Indoor Air Quality Questionnaire

In order to gain information about the occupants' perception, a questionnaire on indoor air quality will be administered. The questionnaire will be distributed and collected during the sampling period. A minimum of 10% of the patrons should be surveyed. The method for selecting patrons to survey should be documented (random seat selection, waiting area, bar, etc.).

Note that in some cases incentives or gratuities may be used with the patrons or the restaurant staff in order to collect the requisite data. For example, the wait staff may be compensated for assisting with cigarette butt counting activities. In situations where the patrons would not normally answer questions, an incentive such as a complimentary cup of coffee may be offered for completed questionnaires. All incentives and gratuities must be documented in the final report.

The method for administering the survey must be documented. The preferred method is for a scientist or technician to administer the questionnaire randomly with patrons circling their answers. Conditions may render this method impractical. Other acceptable methods include distribution and collection by the restaurant staff, and obtaining and recording verbal answers.

This questionnaire is intended to provide some understanding of the patron's response to the restaurant, and should provide some information of value to the restaurateur. The key question is the acceptability of the air quality.

DRAFT QUESTIONNAIRE FOR RESTAURANT PATRONS

We are interested in your opinion. (Please mark your answer)

1. *Gender?*
   - ☐ *Male*
   - ☐ *Female*
2. *Age (years)*
   - ☐ *Under 30*
   - ☐ *30-49*
   - ☐ *50+*
3. *Smoking Status?*
   - ☐ *Former Smoker*
   - ☐ *Non-Smoker*
   - ☐ *Smoker*
4. *How is your health?*
   - ☐ *Excellent*
   - ☐ *Good*
   - ☐ *Fair*

RESTAURANT TEST PROTOCOL

5. *How long have you been here?*
   - ☐ *Just Arrived less than 1 hr.*
   - ☐ *More than 1 hr.*

6. *Are you especially sensitive to chemicals?*
   - ☐ *Yes*
   - ☐ *No*
   - ☐ *Unsure*

7. *How many days each month do you come here?*
   - ☐ *Less than 4*
   - ☐ *More than 4*

8. *Right now, how do you judge each of the following statements about this environment?*
   (Please circle the number)

Strongly Agree (1)	*Agree (2)*	*Neither (3)*	*Disagree (4)*	*Strongly Disagree (5)*
a. The temperature is comfortable.				
1	2	3	4	5
b. The air smells pleasant.				
1	2	3	4	5
c. The environment is too drafty.				
1	2	3	4	5
d. The environment is too noisy.				
1	2	3	4	5
e. The air is too smoky.				
1	2	3	4	5
f. The lighting is acceptable				
1	2	3	4	5
g. The temperature is too warm.				
1	2	3	4	5
h. The air is fresh.				
1	2	3	4	5

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RESTAURANT TEST PROTOCOL

i. *The environment is too crowded*

1 2 3 4 5

j. *The air is too humid.*

1 2 3 4 5

k. *There are unpleasant odors.*

1 2 3 4 5

l. *The environment is acceptable.*

1 2 3 4 5

9. *If you have been here before, how do you judge the conditions now compared to your previous visit(s)?*

☐	*Better*	☐	*Same*
☐	*Worse*	☐	*Unsure*

Thank you

14. SCHEDULING

Test days will be selected to correspond to high occupancy in the establishment. Assuming that the busy days are Friday and Saturday:

Testing of the ________ Building will start on Friday, dd mmm and continue through Saturday, dd mmm. The daily schedule is expected to be as follows:

Prior to testing	Project teams will have an organizational meeting to be briefed on the general test schedule. The ventilation system will be inspected.
Fri. - Sat.	Determine concentrations of IAQ and ETS indicators at the location. Collect and count cigarette butts. Quantify the number of occupants.